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Whoso would be a man must be a nonconformist. He who would gather immortal palms must not be hindered by the name of goodness, but must explore if it be goodness. Nothing is at last sacred but the integrity of our own mind. Absolve you to yourself and you shall have the suffrage of the world.—EMERSON.

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THE BITULITHIC PAVEMENT

By Don Montell Forester, Georgia School of Technology.

One of the clearest and fullest statements of the qualities peculiar to bitulithic pavement, the decisions regarding the patented features of its construction, and the methods of securing the results aimed at by the inventor, Fred J. Warren, which has been made, is to be found in a thesis submitted for the degree of Bachelor of Science in Civil Engineering, from which these extracts are taken, lack of space being the only reason for omitting any part of the production. The earlier portions of the thesis are briefly indicated in abstract, and the latter portion, excluding specifications, is given practically in full.

EARLY road construction of a permanent nature was of the massive type built by the Romans.

Modern road building began with the military roads of Napoleon I. The macadam and telford types were developed in England early in the nineteenth century and are fully described in the thesis. Their life is short under modern traffic conditions and other materials and methods of construction have been devised to increase the economy of road maintenance. The difficulty is to give a life to the road proportional to the increase in first cost. The importance of the invention of the stone crusher and the steam roller is recognized.

The qualities needed in a pavement include (1) good wearing quality, (2) good footing for horses, (3) non-slipperiness, (4) noiselessness, (5) easy drainage, (6) a surface easily cleaned, (7) low cost. The most important problem is to secure the first six qualities at the minimum cost. The new motor traffic makes the problem still more difficult and adds to the demand for a satisfactory wearing surface.

All authorities admit the passing of macadam as a satisfactory pavement for heavily traveled roads.

Asphalt and brick are compared with the ideal and the defects in design and construction are stated in detail in the thesis.

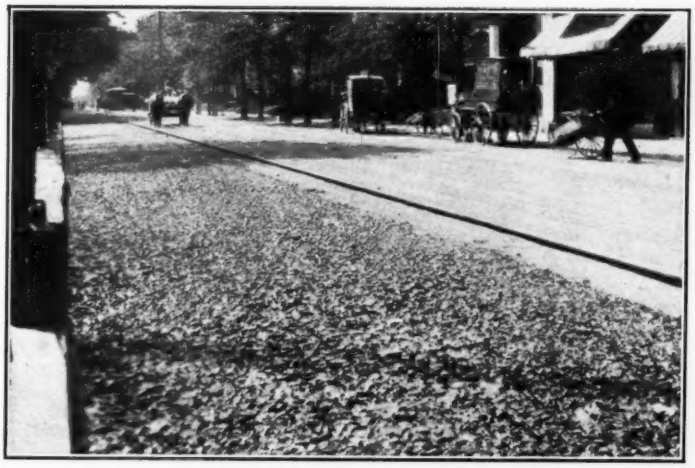
Many experiments have been made to produce a surface that would wear, possess an ability to resist the raveling effects of fast-moving motor cars and still be within a reasonable cost limit. The large amount of macadam in existence was the chief reason the engineers attempted to find protection to the existing surface rather than an entirely new form of construction.

These investigations brought forth two classes of pavements; one where the macadam was treated with different kinds of tar preparations in an endeavor to bind it firmly together and prevent dust. Some of these bituminous macadams have proved quite successful and as they are relatively inexpensive, will more than probably come into popular use where an inexpensive pavement with reasonable wear is needed and a higher priced construction is not warranted. The other class of pavement evolved was one that takes the place of asphalt on city streets and does not possess defects found in he other types, being economical in cost as well as in wear. Of this type of pavement one in particular will be treated which is the subject of this article—namely, "Bitulithic," a patented bituminous pavement.

The influence of the seven Warren brothers on asphalt and bituminous pavement development is shown and especially of Fred J. Warren. He conceived the idea that a roadway wearing surface, superior to anything then devised, could be made of a mixture of bituminous materials and crushed stone, varying in size from a maximum which may be as large as 1½ inches to 2 inches, depending on the pro-

Views of streets in Atlanta, Georgia, paved with Bitulithic, under construction and completed, followed by photographs of parts and the whole of the paving plant used by the Southern Bitulithic Company in the Atlanta work.

Peachtree street, looking south toward Peachtree Place. Foundation of eight inches of stone, rolled to grade and covered with asphaltic cement.



Peachtree street, looking south from Tenth street. Stone base being rolled to grade before coating with asphaltic cement.

posed depth of the wearing surface, down to a minimum size of impalpable powder, the varying sizes being carefully and accurately proportioned so that each succeeding size of particles of aggregate would be in such proportion as to fill the spaces between the coarser particles and so on down to the finest powder, thus producing a compact structure of crushed stone which, irrespective of the bituminous material, would have a high degree of inherent stability and the lowest practicable percentage of voids.

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¶ INHERENT STABILITY *of the broken stone by reducing the voids and consequently the proportion of bitumen to a minimum was Fred J. Warren's basic principle.*

Mr. Warren's idea was to produce a pavement that would:

First—Have a greater durability than asphalt;

Second—Provide a foothold for horses equal to the macadam and, at the same time, maintain a relative or general smoothness of an asphalt pavement;

Third—Overcome the necessary muddy or dusty condition of macadam and provide a pavement that, while having a density of solid stone, would at the same time have great elasticity.

With these basic ideas it took nearly two years' close laboratory study and thought to work out the details, including the devising of the necessary plant, before he was ready to present to the public the new construction, founded on principles so simple that no one had ever before thought of applying them to the building of pavements. The new pavement was patented and was subsequently christened "bitulithic," derived from the Latin word "bitumen" and the Greek word "lithos" meaning stone, the pavement being made of a combination of bitumen and stone.

The vital points wherein the bitulithic surface differs from the ordinary macadam and sheet asphalt are well brought out in "Warren Brothers Company vs. City of Owosso, No. 1828, in the United States Circuit Court of Appeals, Sixth Circuit," from which the thesis makes copious extracts, not necessary to reproduce here, as they have been published in earlier numbers of MUNICIPAL ENGINEERING.

The conclusion shows that the court decisions have supported the validity of the patents by full and accurate courses of reasoning on the complete statements of facts presented in the cases.

George W. Tillson's description of the pavement in a paper before the Franklin Institute is as follows:

"Bitulithic pavement is made of crushed rock and bitumen, the particles of stone being mixed in certain scientifically predetermined proportions as to sizes so as to provide a maximum of density and a minimum of voids, so that the resulting bituminous concrete is nearly as dense as a block of solid stone with a surface that offers as little resistance to traction as asphalt, but one that is not slippery, because the fine stone used in the finishing course provides a gritty surface, similar to macadam, which affords secure footing for horses at all seasons."

In November, 1907, at the meeting of the Massachusetts Highway Association to discuss suppression of dust, Franklin C. Pillsbury, expressing the opinion of the Massachusetts Highway Commission, of which he was a division engineer, said:

"The bitulithic pavement is undoubtedly the best form of pavement to give the desired results (durability and freedom from dust under fast motor-car travel), but it is too expensive for many locations."

A practical expression of opinion was given by the Chicago South Park Commission, which selected it for use on several miles of boulevards, 50 feet wide, after two weeks of investigation and after competitive bids for others forms of pavements.

Bitulithic pavement has now been in use about thirteen years and it has increased from having been laid in seven cities amounting to 16,400 square yards the first year to 129 cities using 5,081,068 square yards in 1913. The following table

Peachtree street, looking toward Eighth street. Bitulithic surface after rolling to grade and before placing flush coating of asphaltic cement and fine stone.

Peachtree street, looking toward Peachtree Place. Top course of bitulithic surface being placed; taken before rolling.

Peachtree street, looking south from Eighth street. Finished street, after placing flush coating of asphaltic cement and fine stone, and rolling. View taken two hours after work was finished.

shows this increase, the amount laid each year and the number of cities:

1901....	7 cities	16,400 square yards
1902....	33 cities	400,831 square yards
1903....	40 cities	915,630 square yards
1904....	45 cities	1,041,724 square yards
1905....	42 cities	1,041,327 square yards
1906....	57 cities	1,508,095 square yards
1907....	66 cities	1,924,222 square yards
1908....	62 cities	1,676,433 square yards
1909....	74 cities	2,071,987 square yards
1910....	97 cities	3,047,276 square yards
1911....	99 cities	4,189,182 square yards
1912....	150 cities	4,830,601 square yards
1913....	129 cities	5,081,068 square yards
1914....	81 cities	*4,112,667 square yards

*Laid and under contract May 31, 1914.

1808 miles roadway, 30 feet wide between curbs....31,857,443 square yards

Bitulithic had been adopted in 312 cities up to May 31, 1914, as a standard pavement. These cities range from Washington, Oregon and California to New York, New Jersey, Massachusetts and North Carolina; from Ontario, Manitoba, Idaho and Alberta to Texas, Georgia, Alabama, Louisiana and Arizona. Its use has become widespread and from every quarter the verdict appears to be in favor of bitulithic. It is true that in some instances it has been reported that the pavement was not successful, but these cases are so rare that it would seem as if the fault lay elsewhere than with the pavement itself. Regarding the durability we find that bitulithic in Newark, N. J., Yonkers, N. Y., Boston, Mass., Pawtucket, R. I., and Springfield, Mass., has been laid from ten to twelve years and with little repairs in that time. On Harvey street, Pawtucket, R. I., bitulithic was laid in 1901 with an 8 to 12 per cent. grade; 960 square yards were used and repairs have been unnecessary since that time and furthermore it is worth noting that the scouring effect of the rain water along the gutters has not been near so great as is usually the case where sheet asphalt is used.

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¶ THE METHOD OF CONSTRUCTION *has been very carefully worked out on the lines here described.*

The specifications for the foundation of the pavement should be made after a careful consideration of the character of the sub-soil or material over which the pavement is to be laid.

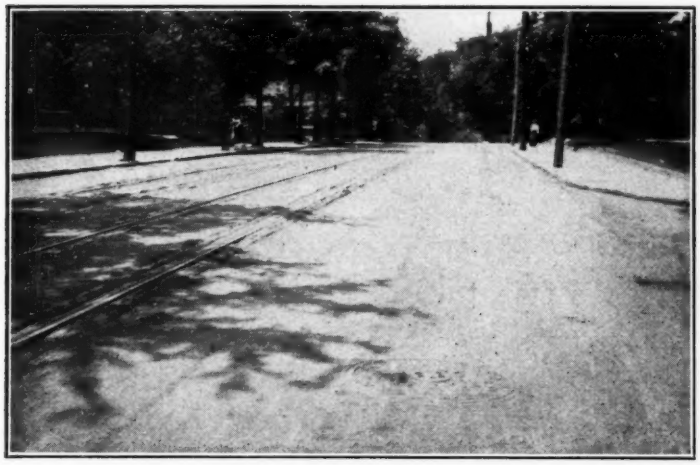
If the sub-soil is such that it can be rolled firm with a heavy roller, a bituminous base is recommended. After the sub-soil is rolled very thoroly it is laid to a depth of 4 to 6 inches or possibly more of broken stone or slag, the pieces varying from 2 inches to 3 inches in diameter; the depth and size varying according to the character of the sub-soil and the traffic to which the pavement will be subjected. This foundation is thoroly rolled with a heavy steam roller. Upon the surface of the foundation stone is spread a heavy coating of specially prepared bituminous cement which fills the crevices between the stone and makes the mass waterproof.

If the sub-soil is spongy clay or other material which cannot be rolled to provide a solid foundation, a hydraulic concrete foundation is not only advisable but necessary. This foundation is mixed and laid in the ordinary way 4 or 5 inches in thickness, depending on the strength of the sub-foundation. In order to present a good bonding surface for the bitulithic work it is very important to roughen the surface of the concrete after it is thoroly tamped but before the mortar has become set. This is done by tamping into the surface rough stone fragments. Before laying the bitulithic surface the concrete is carefully swept.

Where the street to be improved is now paved with macadam or other form of pavement, such as stone blocks, cobbles, or brick on either concrete or other form of foundation, and the condition of the street is such as to permit raising the grade about 3 inches, bitulithic may be successfully used. It is necessary to clean and roughen the existing surface thoroly in order that the bitulithic surface may bond well.

Upon the foundation or base which has been prepared is spread the wearing surface which is compressed with a heavy road roller to the desired thickness, usually about 2 inches. The surface mixture is made of the best stone obtainable, varying in size from a maximum of 1 inch or 1½ inches down to an impalpable powder; the maximum size of stone used in all cases equal to one-half the thickness of

Lee street, looking north from Gordon street. This pavement has been down ten years.



Park street, looking west from Hammond street, in use ten years. Bad condition along car track is due to settling of the track.

Ponce de Leon avenue, looking west from St. Charles avenue. This pavement has been in use four years.

the wearing surface, the various sizes of smaller stone, sand and an impalpable powder being provided to fill the spaces between the larger stones. The proportions used of the various sizes of mineral are pre-determined by physical tests with a view of obtaining the smallest percentage of air spaces or voids in the mineral mixture, and vary with the character and shape of particles of the stone used in each particular case. After the proportions have been determined, the mineral matter is passed thru a rotary dryer from which it is carried up an elevator and thru a rotary screen which separates the mineral into several groups of sizes. The proper proportion by weight of each of these sizes is secured by the use of a scale having seven beams, the exact amount being weighed out and run into a double-shaft rotary mixer. The stone is heated to such a degree in the dryer that it will be at a temperature of about 260° F. when run into the mixer. These proportions of mineral matter are so determined that their combination will have about ten per cent voids. While the stone is in the mixer it is combined with a sufficient quantity, which is accurately determined, of heated bituminous cement to coat all of the stone particles, fill the voids and leave a small surplus. The whole is then thoroly mixed together and dumped while hot into carts or wagons and hauled to the street and spread and thoroly rolled with steam rollers. When placed the mixture should be at a temperature of about 180° F. to 200° F. Heavy rollers, from twelve to twenty tons, are found to be much more efficient than the ordinary rollers. The effect of the rolling is to compress the material to the desired thickness and to make the surface as dense as possible.

After the surface is thoroly rolled a flush coat of quick-drying bituminous cement is applied to the surface, thoroly sealing it and increasing its water-proofness. This coating leaves the surface sticky and into this sticky layer is applied a thin layer of fine crushed stone, varying from ¼ to ¾ of an inch in size, according to the roughness desired. The pavement is then again thoroly rolled. This leaves a final surface that is gritty and well calculated to give purchase for horses' hoofs. The final layers vary with the grade, the greater the slope the larger the stone used. After this final rolling the street may be opened to traffic as soon as the surface has cooled to the temperature of the air.

On streets where car rails are laid, a slightly different form of construction has been found necessary. It has always been found difficult to prevent bituminous surfaces from crumbling or cracking adjacent to the rails, owing to the continual slight movement of the rails and ties under the pressure of passing cars. In bitulithic work this difficulty has been obviated by placing a double row of paving block of stone, wood or brick on each side of each rail. The blocks are laid in a cement foundation and well cemented together. The result has been almost a total freedom from the hollows often seen along the car tracks in sheet asphalt and tar macadam work.

On flat grades a crowned surface is usually adopted, the slope being ¼ inch for each foot of width exclusive of street car tracks. A slightly less crown is used for steeper grades.

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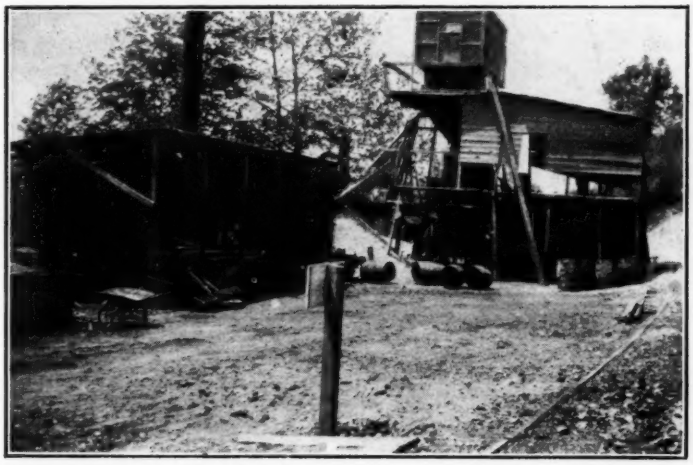
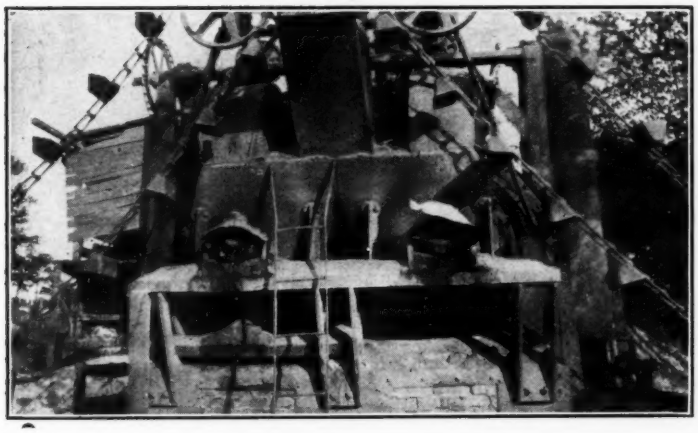
¶ ELABORATE EQUIPMENT *of laboratories, special machinery and materials, and expert direction, do not limit the construction to permanent plants, but permit the use of smaller portable and semi-portable paving plants.*

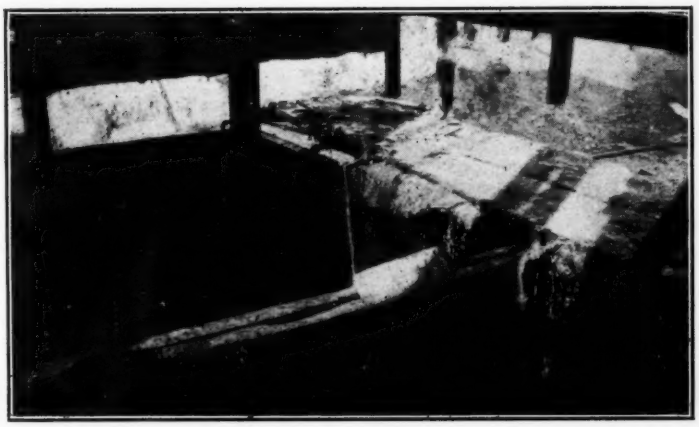
The elaborate outfit of laboratory and machinery and skilled direction required to produce this pavement successfully would seem at first to limit construction to the vicinity of permanent plants, or to sufficiently large quantities of work to warrant the heavy expense for freight charges and installation of semi-portable plants, and these ideas are strengthened by visiting such plants and examining the work in progress. There have, however, been built and patented by the Warren Brothers Company a number of one-car portable bitulithic railroad paving plants, each permanently set upon a platform car so that it may be easily transported over the railroad lines from place to place. These cars are hauled to the cities



General view of bitulithic paving plant, with dryers in the foreground.



View of dryers at intake end.



Top of ogee-bottomed bitumen tanks.

in which it is desired to construct the pavement and are left in some out-of-the-way corner of the yards. The apparatus is then set up on the car and the material prepared, after which it is hauled to the place of operation and spread. These outfits make it possible to build this pavement in many widely distant places and to give to all of them equally reliable results.

The principal parts of the portable plant are:

Boiler and engine.

Rotary dryers for drying and heating the stone.

Elevators for conveying the stone to the desired places in the plant.

Sectional screens for separating the stone into the several sizes.

Sectional bins for storing the different sized stone.

Weighing box resting on a seven-beam scale.

Twin pug mechanical mixer.

Ogee-bottomed bitumen melting tanks.

Bitumen weigh-bucket and dial-scale.

Rotary exhaust fan.

Dust separator for reclaiming dust drawn by the exhaust fan from the stone while it is drying.

Steel platform car.

The permanent plants are about the same, the only difference being the size and arrangement. In addition to the parts named above there are a number of minor appliances. The portable railroad plants are patented and Warren Brothers Company also hold patents for numerous other mechanical contrivances used in the construction of bitulithic pavement. Among these is a machine for spreading the final coat of quick-drying cement and a stone sprinkling machine for spreading the final layer of heated stone chips.

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¶ PRICES VARY *according to cost of labor and materials on the ground and amount of work to be done. Quality is shown by frequent laboratory tests during construction, and proved by satisfaction under traffic.*

The prices of bitulithic pavement vary within wide limits in different localities, owing to variations in the costs of labor and materials, area of work to be done, proximity of the work to railroad sidings and other conditions. The average price in 1912, in some 225 cities, was $2.35 per square yard, ranging from about $1.90 to $2.90. This does not include grading but does include a five-year guaranty.

A sample of the bitulithic pavement taken from the south side of McLandon street, Atlanta, Georgia in March, 1913, while it was being laid and tested showed the following, test being made in the laboratories of Warren Brothers Company:

Bituminous cement, per cent. found.. ..... 7.8 per cent.

Equal to standard.

Mineral extraction after extraction of bitumen—exclusive of bitumen:

Passing screen.	Per cent.
1 1/2-inch	25.1
1 -inch	7.2
3/4-inch	13.6
1/2-inch	17.
1/4-inch	4.2
1/10-inch	22.1
1/80-inch	1.4
1/100-inch	4.7
1/200-inch	4.7
Total	100.0

Ogee-bottomed melting tanks, end view.

Weighing pan for stone. Scale beam on the right.

Twin pug mixer, showing paddles or blades and the carrier and weighing tank for melted bitumen.

BACILLUS COLI IN WATER SUPPLY

ITS SIGNIFICANCE AND IMPORTANCE

By Joseph Race, F, I. C., City Bacteriologist, Ottawa, Ont.

The presence of bacillus coli in a sample of water is not certain evidence that it is dangerously polluted and contains disease-producing germs, but it is a definite warning, not to be ignored with safety, that the water is polluted and the source of that pollution must be determined and kept under close observation at all times, to insure that it does not become dangerous. Mr. Race, in this paper, for which we are indebted to The Canadian Engineer, emphasizes these statements and gives warning against the present tendency to minimize the value of the indication given by the presence of that organism.

WHILE too much importance has been attached in the past to the presence of b. coli in water used for domestic supplies, it is regrettable that the pendulum is now showing a tendency to swing too far in the opposite direction. The paper of Geo. A. Johnson (Pro. Amer. Waterworks Assoc. 1913, pp. 399-455), of Johnson & Fuller, New York, is an illustration of this movement. The all too common practice of using arbitrary and empirical methods in the bacteriological examination of water is partially responsible for the present status res, and in this regard bacteriologists have only themselves to blame. As will be shown later, the mere presence or absence of b. coli in an arbitrarily fixed amount of water may have no significance when considered without regard to other circumstances; and in attempting this we are merely opening the way for criticism. The Committee on Standards of the American Public Health Association (1912) evidently recognized the futility of such procedure when they recommended that quantitative estimations should be made of b. coli. They add: "Qualitative results, when viewed superficially, may seem easier to obtain than, and quite as conclusive as, quantitative results; but detailed evidence shows that in general the quantitative tests are by far the most fruitful source of information." It would appear that the committee might have gone further and deprecated the use of qualitative tests except under extraordinary circumstances. This procedure has also had a deleterious effect on those connected with sanitary work, and who, by reason of their lack of familiarity with the technique employed have accepted this sophism. The author believes that, even with all the assistance that quantitative methods of examination afford, it is often difficult to give a sound opinion on the hygienic quality of a water supply, and that it would be folly to revert to the older methods.

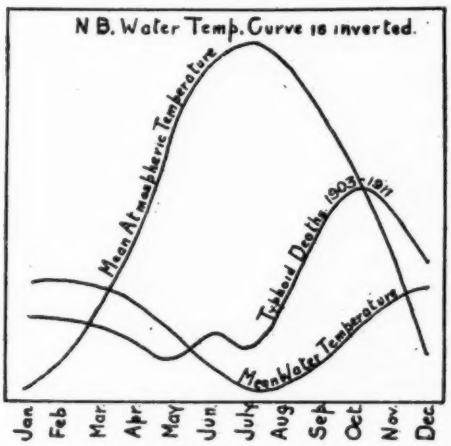
There are many points of difficulty surrounding the significance of b. coli, and on several of these the present knowledge is very meagre. Almost everyone is aware that b. coli is common to the excreta of nearly all the higher and lower animals. In cold-blooded animals the occurence is less constant, and more or less discordant results have been obtained. Dr. Amyot (Trans. Am. Pub. Health Assoc., 1901), concluded that b. coli is not normal in the intestines of fish, and that when present is due to the polluted environment. The tendency among animals generally is for b. coli to become rarer as the zoological type becomes lower. None of the lower types, however, are susceptible to typhoid fever, man being alone in this respect, so that there is a possibility of having b. coli un-

accompanied by b. typhosus. This b. coli has, therefore, no significance.

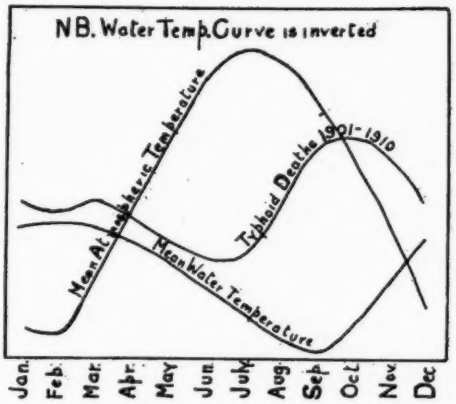
In reference to the b. coli present in a water supply and due to human sources, it is important that information should be obtained regarding the total population on the watershed, the prevalence of typhoid and the probable period elapsing before the diluted sewage reaches the water services of the town under consideration.

The population is comparatively easy to obtain, and the typhoid death rate can, in most cases, be calculated from past records. In addition to the mortality, however, the case incidence should also be considered, as this has an important bearing on the probable ratio of b. coli to b. typhosus by its inflence on the number of carriers. In Great Britain and certain portions of Europe the incidence is much lower and the case mortality higher than on this continent, so that the ratio of b. coli to b. typhosus is enitrely different. It is possible that this ratio is ten times greater in North America than in Europe, and much greater sigficance ought, therefore, to be attached to b. coli here.

The period elapsing between the discharge of the sewage and the withdrawal

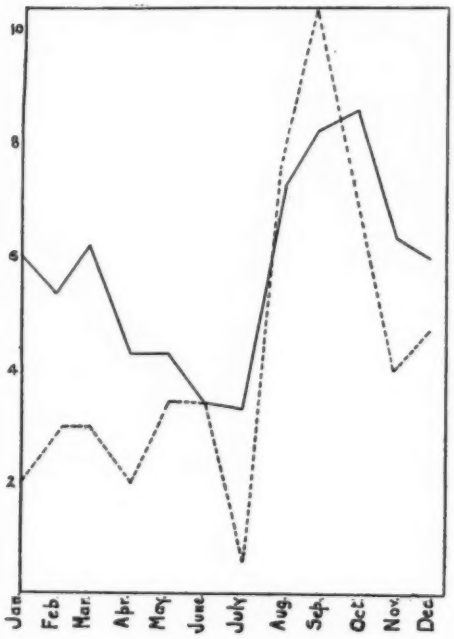


TYPHOID DEATHS *in Ottawa. Average each month for years* 1903 *to* 1911, *compared with the mean atmospheric and water temperatures. The curve of water temperatures is inverted to show more clearly the parallelism of the curves, cold water corresponding to longer life of b. typhosus in the water.*



TYPHOID DEATHS *in Toronto. Average each month for years* 1901 *to* 1910, *compared with mean atmospheric and water temperatures, the latter curve being again inverted.*

of the water is the most important factor, and in this connection the temperature of the water must be considered. Typhoid bacilli, in the absence of suitable food material, find an unsuitable environment in water, and, the cell energy being entirely of a katabolic nature, they die rapidly. It is obvious that this increases with the period of storage, and a consideration of the mechanism of the process also leads to the conclusion that the katabolic wasting increases with rise in temperature and vice versa. Dr. Houston and others have supported this hypothesis, by numerous and conclusive experiments. It is important, therefore, that the bacterial contamination should be considered in its relation to the water temperature, and this leads to the conclusion that b. coli should be regarded as having greater significance in winter than in summer. In the diagrams illustrating this point the temperature curve has been inverted so as to conform with the viability of typhoid in water. In both the Ottawa and Toronto diagrams the typhoid death curve and the inverted water curve show a noticeable parallelism in the winter months, and as it is during these months that outside cases are at a minimum, the typhoid incidence is probably water-borne. The plotted figures for Toronto before and



TYPHOID DEATHS *in Toronto. The full line shows the average number each month in the years* 1903 *to* 1911, *before filtration was begun. The dotted line shows the averages in* 1912 *and* 1913, *after the filtration of the water was begun. Note the reduction in typhoid in the colder months. The high summer rate is attributed to imported cases, which filtration of the water would not affect.*

after the operation of the filtration plant show that it is this winter rate that has been reduced, whilst the summer prevalence, mostly due to imported cases, has remained unaffected. In Ottawa, with efficient sterilization with hypochlorite, only one case of typhoid has been reported for the first four months of the present year. These results show what can be accomplished by water purification, and also that the significance of b. coli must not be considered in an arbitrary manner.

Attempts have been made to belittle the value of the b. coli test because the b. coli content of the water supplies of certain cities did not bear a constant relation to the typhoid death rate. In such statements the sources of the typhoid incidence are not stated, and this, in many cases, may lead to erroneous conclusions. From the above remarks it is not to be expected that even typhoid rates due to water will closely correspond with the b. coli content; all that can reasonably be anticipated is an approximate agreement. Cities with high b. coli contents will tend, *caeteris paribus*, to high typhoid rates and the removal of b. coli to decreasing rates. Let everyone remember that the b. coli test is not a positive test for the presence or absence of pathogenic organisms, but an inferential test of danger and of potential injury to public health.

HOUSTON'S PAVING PROGRESS

The great paving movement now under way in Houston, Tex., is one that entitles both the municipal administration and the citizens who are co-operating to unusual credit, because it is preparing the city for the best growth it has ever enjoyed. One can never know just how much the mud lanes have retarded Houston's growth, but all will learn within five years how paved streets contribute to the general progress. The value of the present paving program is far greater than the pavements actually being constructed, because of the sentiment for good streets that is being created in every section of the city.

Another important feature of the paving program is the fact that in all cases the paving is preceded by sewerage and drainage, which are to insure for the future not only good streets, but ideal living conditions and good sanitation. The pavements are being put down to remain—not to be torn up and destroyed every time it becomes necessary to make sewerage or water connections.

Mayor Campbell, the commissioners and the citizens who are co-operating deserve the commendation of all the people for the splendid progress that is being made in lifting the city out of the mud. The financial sacrifices that have been made and that are being made are well worth while.

THE CITY MANAGER

THE LATEST PLAN FOR MUNICIPAL MANAGEMENT

By Paul E. Kressly, C. E., City Engineer, Inglewood, Cal.

After a brief experience of the plan in operation, the city manager in one of the latest of the small cities to adopt this new plan for managing the daily affairs of cities describes briefly the development of the idea and states the improvements which it is expected will result. The advantage to the small city in having all its activities under the control of a single expert always on the job, instead of under many elected officials, who can spend only the odds and ends of their time in the city's business, should be evident very shortly, especially since he should be able to save enough money so that the city can afford to employ the most experienced and competent man available.

THE city manager, the latest innovation in the government of American municipalities, is a result of the Galveston hurricane. When, fourteen years ago, wind and wave conspired to wreck the Texas island city, the conditions created by the catastrophe demanded so much progressive and constructive work of the city government that the old system of a board of aldermen and independent elective officers broke down. A group of business men petitioned the state government to suspend the local government and replace it temporarily with a commission of five men on a strictly business basis. The commission in a few days accomplished what a city council would have required months to do. Des Moines, the Iowa capital, improved the idea, and from that beginning the commission form of government has spread with surprising rapidity thru the United States, and a peaceful revolution in over three hundred cities has swept away the boards of aldermen, mayors and a host of minor officials and set up new municipal governments on a plan so simple that the services of the "political boss" are not required to direct them.

While this form of government is a vast improvement over the form in general use up to seven or eight years ago, there is unquestionably room for still more improvement. In some cities it has proved very successful, while in others it has been a complete failure. In some cities the weaknesses of commission government are beginning to appear in a very striking way.

For example, in Wichita, Kan., the commission has authorized the issue of $88,000 in five-year bonds to cover current deficiencies. After four years of the new rule, that does not look like good business. Certain things in the local situation are directly or indirectly responsible for this condition. One of the members of the commission is an ex-street laborer, an honest calling, but one scarcely giving a man the preparation for managing one of the departments of a city as important as Wichita. A reputation for integrity and honesty cannot insure a good business manager.

It is only by accident that you can secure five men who will be at the same time perfect representatives of recognized divisions of the people and at the same time properly equipped for administrative service. Each commissioner naturally wishes to make a record for himself in his departmental work, so he pulls for a larger slice of appropriations in the council, and when all five commissioners do the same thing the annual budget must be stretched accordingly. Therefore, when the commission is not composed of the proper men, who will work together, the government can in fact be resolved into five separate governments.

The great thing the commission form of government has done, is to demonstrate

the wisdom of giving over to a single elective governing body all the municipal powers. It has given the people a workable instruemnt, so far as general regulation is concerned, but it has failed to give the governing body the means with which to translate the geenral will of the people into detailed acts of government in the most effective way. A five-headed government carries with it the possibilities of friction, which leads to inefficiency, which in turn, leads to waste and even corruption. Furthermore, we cannot secure municipal experts by the process of popular election.

We must build upon the solid foundation of popular control, which commission government has laid, the structure of a strong and well-conceived administrative organization. We must separate the functions of the representative from those of the administrative body, not by a return to the discredited system of the separation of powers, but by retaining the unity of powers in the hands of a single elective body. The governing body must carry out its orders thru a strong, unified, harmonious administrative organization under a strong and expert executive. This will be the real "business plan," and it will be thoroly democratic.

It is on the administrative and executive side that the city-manager plan introduces a radical change. Commission government in the old sense is a five-headed affair. The city-manager plan does away with this five-headed feature and substitutes a single head, not with advisory powers merely, but, under certain safeguards, with the powers of administrative "life and death" thru actual control of appointments and removals.

The chief executive or city manager is not an elective officer, but is appointed by the council; he, therefore, does not divide responsibility with the council, but is subordinate to it; he need not be, at the time of his appointment, a resident of the city, but may be chosen from anywhere in the country; he is not chosen for a definite term, but holds office so long as he gives satisfaction to his superiors. The controlled-executive plan filters everything thru a group. It reduces the personal equation. Without loss of administrative unity, it abolishes one-man power. This officer corresponds to the general manager under the board of directors in a business corporation. It gives the stability of the combined judgment of many men on matters of policy, but leaves execution to a single-headed controlled executive establishment. It is the universal plan in corporations and in all associations employing paid servants. It is likewise a standard plan in governments outside of the United States.

In some foreign countries parliament elects and controls the prime minister, who in turn controls the administration. The magistrate of a German city, with general power of appointment over the whole administration, is hired by the council and subject to continuous control by it.

For the highest efficiency we must put the chief administrative official, as well as subordinate officials of the same sort, on a professional basis, and take the matter out of politics by relieving him of all except purely administrative duties. That is not saying, you will notice, or even implying, that "the people cannot be trusted to choose" the chief administrator; it is implying merely that they are not in a position to do so to advantage.

In so far as a mayor is a mere administrator, he should be supplanted by the city manager, and in so far as he is a deliberative or policy-determining official, he should be supplanted by the commission as soon as that body has been made, by the application of proportional representation to its election, truly representative of all of the voters.

There is every advantage in giving the responsibility for the appointment and retention of the city manager to the council or commission. Instead of changing completely with the turn-over of a few votes at any election, as would frequently happen in the case of a mayor elected at the polls, the council will change in complexion only as fast as, and to the degree that, the whole body of voters changes. Thus the council is the most stable basis for the managership to rest on. Moreover, if the city manager is not to be elected by all the voters, and if he is to be kept in office indefinitely so long as he is satis-

factory to those who appoint him, as is required in the interest of efficiency, it is obviously important, in the interest of democracy, to entrust his appointment and his retention to the one body in the government that can be made truly representative of the whole electorate.

Efficiency and democracy, then, the two fundamental requirements of the ideal city government, are satisfied by the city-manager plan, and accomplish all that its advocates maintain.

The city manager should be a civil engineer with municipal engineering experience, who should also possess the qualifications of an economist, a financier, and have executive ability. What other profession has men who are better qualified as municipal experts than the engineering profession? A capacity to get at the facts in any case, supplemented by good judgment, are predominating traits, characterizing this profession more prominently as essentials than any other profession or calling.

The board of trustees of the city of Inglewood followed the very rational plan of appointing as city manager the writer, who had served as city engineer for two years. In the ordinance passed by the board creating this new position, they delegated practically all of their executive and administrative powers to the city manager, and they have given their personal assurance of their loyalty in anything he may undertake to perfect the organization and place the affairs of the city on a business basis. The ordinance was passed on the 2nd of March, and legally did not take effect until thirty days thereafter, but the board deemed it necessary that I be appointed and assume the duties of city manager at once.

The ideals upon which to erect the superstructure of my organization are efficiency and economy. To make my administration successful in these respects, I was obliged to make quite a few changes in the organization of several departments. Being familiar in a general way with the weaknesses of the various departments, I determined in order to correct them, that the requisites of all employes should be efficiency, economy, honesty and loyalty. Employes who possessed these qualifications are retained regardless of their political faith. A few dismissals were necessary, as this city, like many others, was not without political office holders, appointed regardless of qualifications or fitness. I will not attempt to describe the reasons for the dismissals, but I wish to state that if any of my fellow-engineers ever receive the appointment of a city managership, and they are obliged to dismiss employes, they need not be discouraged by threats and wild epithets hurled at them by "political bosses" and their followers, since this is a natural procedure in the course of uncovering the efficient and economical(?) work of their "pets."

There is an erroneous impression grounded in the minds of many municipal employes that they are not required to do as much work as for a private corporation: They labor under the pretext of the old political saying "to the victors belong the spoils," and are therefore justly entitled to be given employment, and to do whatever they please, irrespective of the quality or quantity of the work performed, or of their value and worth to their employes, or interest taken in the business affairs of the city.

The following is a brief summary of some of the important movements to be undertaken, and changes in the various departments:

1. The removal of inefficient and incompetent men from the city service.

2. Requiring all employes to obtain an order, signed by the city manager, for the purchasing of machinery, tools, supplies, materials, etc.

3. Accounting system installed and providing balance sheets of all accounts.

4. Limiting all city departments to a limited expenditure, and providing for an emergency fund, all within the actual revenues of the city.

5. Monthly detailed reports from each department.

6. Installation of unit cost system, where practical, in all departments.

7. Enlarging and defining the duties and powers of the park commission to exercise control and supervision of all parks and street tree planting, and of beautifying the street and avenue parkways by

the formation of assessment districts to pay the costs and expenses thereof.

8. Arranged with electric light and telephone companies to have poles removed from streets and avenues into alleys.

9. An ordinance prohibiting the trimming of street trees by property owners, and delegating these duties to the park commission, and prohibiting the destruction of shade or ornamental trees, shrubs and flowers, and providing penalties therefor.

10. A resolution providing for the removal of weeds from street parkways, at the expense of the property owners.

11. Commission appointed to revise building ordinance.

12. Commission, composed of five members, one each from grammar school trustees, school teachers, Parent-Teachers' Association, Woman's Club and city manager.

13. Providing more convenient and enlarged quarters for the public library.

14. Establishing more stringent rules and regulations governing the care of buildings and apparatus in the fire department.

15. Increased the efficiency of the building, plumbing and electrical inspectors' department, and placed it on a revenue producing basis.

16. Motorcycle officers ordered to strictly enforce ordinances pertaining to speeding on boulevards, and prohibiting heavy hauling on certain avenues.

17. Arrangement made with fire engineer to co-operate with city marshal's department to receive calls for his department, and thereby greatly increasing the efficiency of the police department.

18. Consolidating the city engineer's and street superintendent's office, which heretofore were entirely separated. The city engineer having charge of all new improvements, while the street superintendent had charge of the maintenance and repairs.

19. The removal of incompetent, inexperienced men from the service of the street department, and placing competent, experienced and able-bodied young men in their places, reducing the force to half the number.

20. Systematizing the work of the street repair and maintenance department, and establishing a unit cost system for the various classes of street work.

21. Provision for a material supply yard adjacent to railroad, and the housing of roller, graders and other implements.

22. Movement under way to require all public utility corporations to take out permits for all street excavations, and requiring a deposit with street superintendent of an amount sufficient to cover the expense of replacing street surfaces to the original condition. Said work to be performed by the street superintendent.

23. The collection of rubbish and garbage.

24. Placing of receptacles for paper, rubbish, etc., along the principal streets of the city.

25. Effected the co-operation of the police department with the health departmen enforcing quarantine ordinances, and the strict enforcement of all ordinances pertaining to the health of the citizens and cleanliness of premises.

26. Compelling all employes to observe the following working hours, viz: 8 a. m. to 12 m., and from 1 p. m. to 5 p. m.

27. Permission must be obtained from the heads of departments before any employe is permitted to leave his regular duties.

28. Requiring an inventory of all office furniture, fixtures, supplies, machinery, tools, material, etc., to be submitted to the city manager.

The ordinance creating the city managership in Inglewood, defines his duties and powers, and gives him authority to exercise control over all departments, but expressly excepts the legal department from the operation of the ordinance. In my opinion, based upon past experiences, this is a serious defect. The city attorney should be under the control of the manager, because there is not a single department in any city which causes more delays in public improvement proceedings than the legal departemnt. These delays are a handicap to the engineering department, oftentimes proving to be an additional expense, which could be avoided if the city manager exercised control over that department.

STREET CLEANING AND REFUSE DISPOSAL

IN PHILADELPHIA

By William H. Connell, Chief of Bureau of Highways and Street Cleaning.

These extracts from Mr. Connell's forthcoming annual report show the advantages of placing an energetic and competent man in charge of a bureau, especially of one with the multiplicity of detail involved in street cleaning, refuse collection and disposal. Street repair is also included in the duties of the bureau and the results show the same energetic attention to details of operation shown in that branch of the work.

THE street cleaning contracts, which include the collection of ashes and rubbish, were operated during 1913 for the first time under the revised specifications. The street cleaning specifications, instead of containing the indefinite requirements characteristic of the former specifications, are entirely definite in character, and stipulate in a clear and concise manner what is required of the contractor. The frequency of street cleaning, the number of blockmen and the amount of certain classes of equipment is definitely stipulated, and as a result work under the street cleaning contracts was not only performed better than in former years, but was capable of more exact control.

In the supervision of the contracts for street cleaning a radical departure was inaugurated by handling the inspection of the work thru the district engineers, thus making the street cleaning an integral part of the general highway work. The former administrative method of handling this work thru a separate division of the bureau, naturally resulted in a considerable duplication of effort, which has been entirely eliminated with the existing organization, thus not only giving a more adequate inspection, but also reducing the cost of this service.

At the beginning of 1913 the bureau was in the unfortunate position of having almost no data relative to the amount of cleaning performed, the amount of materials handled and other essential information pertaining to this work. During the year special investigations and studies have been made for the purpose of obtaining data, so that the bureau records now show what work is being performed under these contracts. In addition to the obtaining of street cleaning data much work was necessary in perfecting the engineering details of operation. Definite studies were made of the schedules of each class of work performed on the different streets and the work under these contracts has now been so systematized that not only is the frequency of cleaning on each street formulated, but the character of street cleaning machinery to be used on each street, the amount of cleaning required and such other matters have been definitely regulated. These studies are by no means completed, but the work that has been done, together with the plans projected for 1914, will place this work on a basis comparable with the up-to-date municipalities, so far as is possible under the contract system.

The uniforming of the men employed under these contracts has marked a new era in street cleaning work in Philadelphia, and has met with universal approval; for, aside from the generally pleasing appearance of the "white wings," there has been a marked advance in the esprit de corps among the men, which has raised the standard of the work performed and last, but not least, the innovations inaugurated in conducting this important branch of the municipal service

STREET CLEANING *in Philadelphia. Squeegee gang preceded by sprinkler.*

have placed the contractors on their mettle and have tended to arouse their pride in the work in their respective districts; and thru promoting friendly rivalry among the contractors, it is hoped that the standard of their respective organizations will be improved, which will not only give them a more complete control over their work, resulting in a direct economy to them, but will generally improve the service rendered to the city.

The standard of the equipment has also been materially improved during 1913 and thru a strict enforcement of the new provisions in the specifications that all equipment shall be kept clean, and stipulating a fine for violations of this requirement, it is expected that the sightliness of particularly the ash and rubbish wagons, will be greatly improved during 1914.

The street cleaning work, of course, involves so much detail for which there are no definite units to specify and bid for, and furthermore it is of such a character that the overhead charges for proper inspection are disproportionate to the cost of the work, that unquestionably it could be much more effectively and economically carried on directly by the municipal forces instead of by contract. It might be well in passing to call attention to the fact that of the twenty-five largest cities in the country, Philadelphia is the only one which performs this work under the contract system, and if legislation could be obtained permitting the work to be done by municipal forces, much better results could be obtained.

It is fully recognized that effective work in cleaning the streets and disposing of waste cannot exist without co-operation of the general public, and an effort has been made by the bureau thru means of the different civic and business men's associations to reach the people in an endeavor to obtain their co-operation, and while much improvement is still possible it is felt that a substantial advance has already been made along these lines.

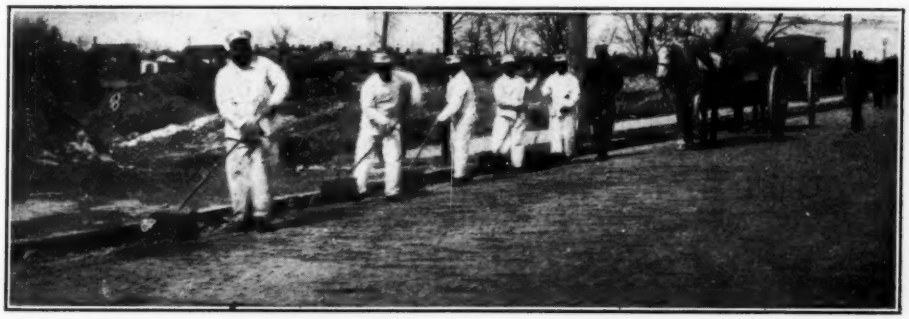
In connection with this educational campaign, 1,490 waste paper receptacles were placed in prominent locations thruout the city and they have proved such a success that it has become apparent it will be desirable to place about five times as many more of these cans at suitable locations thruout the city, such as, for example, two in every block in the principal business section, in front of all school houses, entrances to elevated

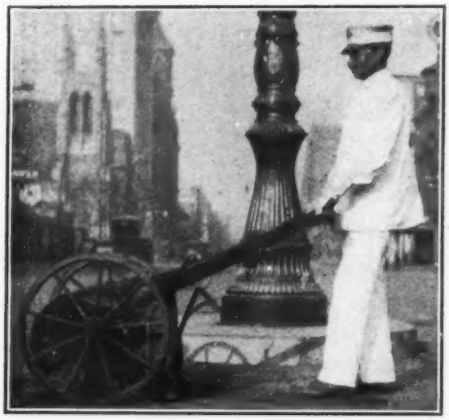
STREET CLEANING *in Philadelphia. Sprinkler and two machine brooms, followed by the gutter cleaning gang pick-up carts shown in the photograph below.*

and subway stations, etc., during 1914. Several circulars have been sent to each householder thruout the city, containing important information and instructions designed to improve conditions with regard to suitable and uniform receptacles; the separation of ashes from rubbish, and other matters in which the co-operation of the householder is required. In addition to these circulars, bulletins and letters of information have been distributed among the Business Men's Improvement and Civic Associations, for it is fully recognied that effective results in street cleaning work can only be accomplished thru such co-operation, as the individual can probably best be reached thru associations of this kind.

As one of the most effective methods of reaching the householders is thru the women's organiations, a woman inspector was appointed to keep in touch with the activity of women's clubs and to secure their co-operation in this work. This inspector has, during the year, given over two hundred lectures to various organiations, and has enlisted the co-operation of householders, women and children in connection with preventive street cleaning measures, thru club, church, settlement and school meetings. The housekeeper has been shown how vital is her part in an efficient system of collection of all wastes. Children have been impressed with their duties as citizens and given a welcome responsibility in demon-

GUTTER CLEANING *and pick-up gang.*





BLOCKMAN *with hand machine broom.*

strating their knowledge in the home, school and on the street, and as a reward for such activity five thousand buttons have been distributed in six months. To assist in the promotion of this work, 20,000 folders for children and adults, relating to the care of the streets and the collection of wastes, were put into circulation and a ready response has everywhere been manifested.

The new housing law enacted during the year has given the city the right to standardize the type of receptacles used for ashes and rubbish and the 1914 specifications require the householders to use receptacles of a proper standard.

A special effort was made in the latter part of 1912, and continued in 1913, to compel the householders to separate the ashes from rubbish and waste. In other cities the rubbish is a source of considerable revenue, which is now being lost to Philadelphia, owing, primarily, to the proper separation. In the specifications for 1914 a provision has been made for

BLOCKMAN *with improved bag carrier for sweepings.*

failue of the householders to make the the rubbish delivered on the street cleaning dumps to become the property of the city, and it is proposed to offer this rubbish for sale to the highest bidder. While the rubbish will not have any great value at first, it should within a year or two—when effective separation of waste is obtained and the scavengers are eliminated—yield a return of $100,000 a year. Many of the details of this work, however, cannot be permanently bettered until new legislation is obtained, which would be effective in preventing operations such as scavenging, sweeping and throwing materials into the street, prohibiting overloaded vehicles, etc. Legislation does exist regulating most of these matters, but

UNIFORMED FOREMAN *of street-cleaning gang with bicycle.*

RUBBISH WAGON *of Philadelphia standard type. Note rubbish boxes near horses, rubbish barrels at rear of wagon and ash cans at extreme left; all set at edge of sidewalks to wait for the wagons.*

the laws are not sufficiently drastic to enable the bureau to properly control the situation.

The week of April 28 to May 3 was set aside as a special "Clean Up" week, to better the health conditions and appearance of the city. In order to bring it to the attention of property holders, the plan was advertised as widely as possible, thru the daily papers and pamphlets distributed to every householder. In addition, placards were placed in store windows, trolley cars and railroad stations calling attention to this movement. Every possible means of obtaining active co-operation was used, the civic organizations, public schools, Boy Scouts, all enlisted their services in this work. During "clean up" week the amount of rubbish collected by the city amounted to 34,379 cubic yards. The refuse spread out on a city square 300 by 300 feet, would rise to a height of 29 feet, or the height of a two-story dwelling. With the plan to make "clean up" week a yearly affair, it is believed that this work will materially improve the health conditions of the community as well as the sightliness of the streets.

As a result of the detailed studies of street cleaning made during the year, the schedule of frequency of cleaning specified for work during 1914 was placed on a more practical basis than in the 1913 specifications, which were drafted without sufficient data being available to form a proper basis. The 1914 schedule has been so revised that the actual yardage to be cleaned each day has been slightly reduced, and yet the distribution of the cleaning has been so arranged that much more effective work will be performed during the coming year. The number of blockmen employed in each district was also reduced on an average of about twenty per cent. Notwithstanding this, with a more thoro control over the manner in which they are distributed and carry on their work, together with the better grade of men that is required under the 1914 specifications, it is believed that this smaller force can actually accomplish as much, if not more, than the larger force did during 1913.

The detailed studies which were made during the year were also of great value in determining the actual cost of the work to the contractors. When the 1914 work was advertised and bids were received, it was found that the low bidder in six of the eight districts bid a price which represented a fair cost and fair profit for the work, but that the bids received for the other two districts were excessive. These two districts were, therefore, readvertised

ASH WAGON *of Philadelphia, standard type.*

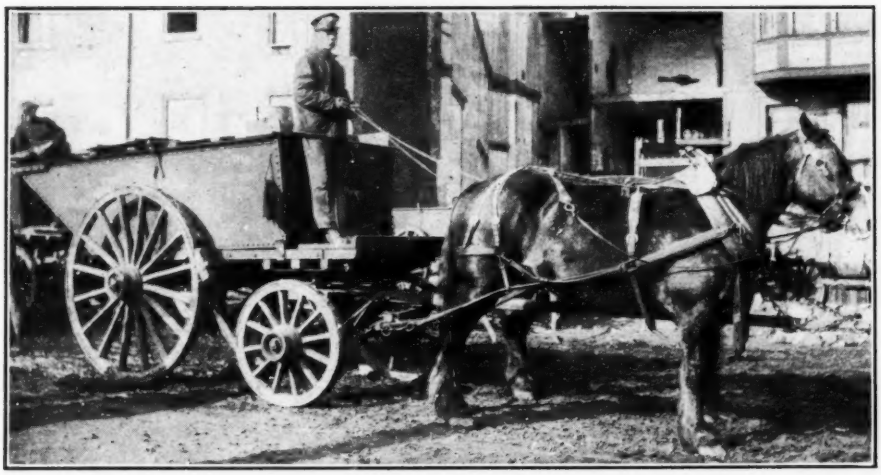
and the bids received at the second letting aggregated $51,700 below the bids first received. This saving is a clear indication of the value and importance of collecting data on this class of work thru engineering investigations.

The garbage contract—like the street cleaning contracts—was operated in 1913 for the first time under the revised specifications and the work, as was also the case with the street cleaning, was placed under the jurisdiction of the district engineers.

The American Product Company was awarded the contract for collecting garbage during 1913. The contract was operated satisfactorily for the early months in the year. In the summer, however, there were rumors that this company was financially embarrassed and as a result the operation of the contract became unsatisfactory in August, and the conditions were so bad in September that the contract for collecting and disposing of garbage was cancelled and the work was given to another concern, at a slight advance in price over the former contractor. During the year a special effort was made not only to better control this work thru more careful inspection, but to obtain data in regard to its operation, which heretofore has been lacking.

It is unfortunate that the contractor who first did the work in 1913 was not able to continue in business, for with only one concern now operating it will be difficult to obtain competition in bidding for this work in the future years. It is particularly fortunate, however, that the contract was advertised and bids received for the 1914 work in July of 1913, as this insured competition and resulted in obtaining a fair price for the work which in all probability would not have been the case had it been advertised at a later date, as the financial troubles of the American Product Company left only the Penn Reduction Company in the field without a competitor. This branch of the service can never be put on an efficient working basis until provision is made by legislation either for a long term contract, or for the city to erect and operate its own disposal plant, which is preferable.

Another condition making it difficult to properly handle this work is the operation of the private collectors. It is estimated that at the present time about half, and, of course, the best half, of the garbage is taken by private collectors, which not only makes it more difficult for the contractor for garbage collection and disposal to operate at a profit, but makes the situation difficult to control, as a very large proportion of the complaints received by the bureau are found, upon investigation, to be due to the improper



GARBAGE WAGON *of Philadelphia, standard type.*

work of these private collectors. Legislation regulating and restricting the operations of these collectors is very much needed and it is hoped that the efforts now being made to eliminate "piggeries" will in a larger degree affect the activities of these private collectors.

PROFITABLE CONVERSION OF CITY GARBAGE

By a London Correspondent.

A METHOD of garbage disposal which is finding considerable favor in England and which has been adopted amongst other towns in Southwark, Hove, Halifax, Blackpool, etc., consists in converting the house refuse collected by municipalities into a marketable fertilizer. The plant comprises a patent disintegrator or dust manipulator, a conveyor and an electric motor for driving. At Southwark, London, there are four sets of the machinery which are erected in pairs, the two pairs facing each other, the conveyors conveying towards the center and discharging the output into a railway truck for immediate dispatch. The whole space occupied by the plant is only some 50 feet by 20 feet and no costly buildings are required. The machine which actually does the work is the dust manipulator which is a strong and powerful centrifugal force disintegrator. The dust carts tip their loads on a sheltered platform some 20 feet by 12 feet, where large tins and leather, which fetch a good price, are thrown aside by the workmen, while the remainder, including broken glass, crockery, slates, wood, and small tins, in one word, the whole of the unpicked refuse, is shovelled into the hoppers of the machines for treatment. In a second or two after entering the machine the house refuse finds its way out and falls on the conveyor in a uniform mass which cannot well be distinguished from dark, rich loam. Occasionally, a few very small bits of paper appear here and there on the surface, but these disappear very quickly owing to the disintegrating action of a rapid fermentation accelerated by the pounding the refuse received while passing thru the machine. One very noticeable point is that immediately after treatment this mass, which previously had a most unpleasant smell, has entirely lost it and is not objectionable. The stuff thus treated is now ready to be spread at once on the soil as manure. Of the four dust manipulators at Southwark three are in constant use, one being kept in reserve and used when wanted. We understood that the output amounted to some 70 tons per day, and that the manure sold by the council to farmers and kitchen gardeners in Kent amounts to something like 18,000 to 20,000 tons per year. This manure is sold at 2s. 4d. (56½ cents) per ton. Each machine is capable of treating up to 4 or even 5 tons of refuse per hour. The whole operation is performed in a manner cleanly, quiet, and free from any suspicion of nuisance, and the economical principle of giving back to the soil what comes from the soil is put into practice.

PROFITABLE SMOKE PREVENTION

By W. C. Kirkpatrick, Chicago, Ill.

The author is a close student of the subject of smoke prevention and possesses a thoro knowledge of the principles of combustion. His statements in this article are striking and will attract the attention of those who are interested in alleviating one of the nuisances of modern city life. While engineers and scientists may not in all cases be in agreement with the author's views, and while it is possible that the author may have over-estimated the extent of the nuisance produced by smoke, the article contains many points of interest and value to the student of the problem.

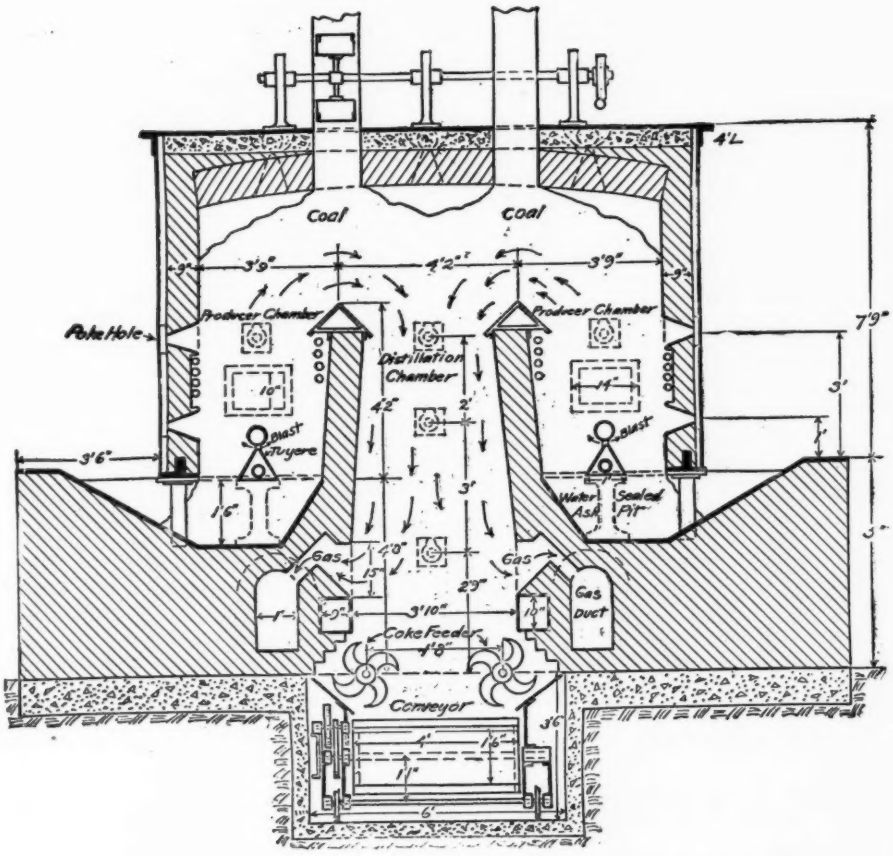
IN the May issue of MUNICIPAL ENGINEERING, the writer endeavored to show what losses are caused by the generation of smoke. Not only do we lose this value direct (which is approximately five million dollars per year), but we have another loss in the damage from the result of the smoke. In fact, it is almost impossible accurately to estimate the loss due to smoke thruout our cities where soft coal is used.

The soot and tarry matter deposited from smoke constantly adds large volumes of filth to the streets, to the windows and doors, to the out and inside walls, to furniture, decorations, etc., and constantly keeps thousands of people at work cleaning, which great expense could be avoided by the use of smokeless fuel.

Many plants have been erected and successfully operated for years to distill, carbonize or coke coal but nearly all of the successful plants are very expensive in first cost, making it prohibitive to many industries, furthermore, they operate periodically, instead of continuously and hence do not produce uniform products and most efficient results. Professor E. J. Babcock, dean of the School of Mining Engineering at the University of North Dakota, has designed, erected and placed in successful operation a plant for carbonizing lignite coal in which the heavy hydrocarbons are extracted from the gas as it leaves the retort, remixed with the carbon, and briquetted, resulting in the production of a high grade domestic fuel, a weather-proof briquette with almost the same heating value as anthracite. The gas and other by-products are also available for commercial purposes.

The idea is not new, but the method employed to obtain low temperature distillation continuously and automatically is new, altho based upon two old and well-known undisputed facts: First, that ordinary producer gas is produced at a high temperature and leaves the producer at not less than 1000° F. and all free oxygen admitted in the producer is consumed in the production of producer gas; second, ordinary bituminous and lignite coals distill at a low temperature or commence to distill at 212° F. and if in direct contact with a gas at 700 to 1000° F., distilling very rapidly.

Therefore, by erecting a rectangular chamber with two partitions extending part way up toward the top, dividing the base into three distinct and separate chambers, all being fed continuously and automatically, and by having the gas exhauster and the outlets at each side near the base of the central chamber, then by operating the two outer chambers as ordinary producer-gas chambers in the production of high temperature, low value gas, the gas rises to the top of the partition and is drawn down thru the fuel in the central or distillation chamber. As each cubic foot of this gas contains large quantities of sensible heat, and as the heat is applied to the coal in the central chamber in the absence of free oxygen,



SECTION OF FURNACE *producing distilled coal and fuel gas from bituminous coal.*

the coal in this chamber is distilled, giving up a portion of its volatile in the form of coal gas, which mixes with the producer gas, forming a combination of coal and producer gas. The combination gas passes down thru the lower bed of distilled coal, which partially acts as a scrubber on its way to the exit. Hence the hot producer gas is cooled and converted into a combination gas or enriched in the distillation process. In actual practice, 10 per cent. of the total quantity of coal delivered into the generator is consumed in the production of producer gas, and the heat liberated in this reaction in evidence as sensible heat of the gas is sufficient to distill the 90 per cent. as it passes down and out thru the central chamber.

The distilled coal passes downward by gravity onto a traveling grate and discharges thru a water seal to the outside. This coal is subjected to a temperature of from 600° to 1000° F. for about one hour, and is in direct contact with and entirely submerged in a constant flow of high temperature gases, rapidly reducing in temperature as it passes downward.

The writer wishes to lay emphasis on the fact that this resultant fuel is not coke, but semi-coke which still retains sufficient volatile constituents to permit its use in an open grate, hot air furnace, hot water furnace, base burner, and for the generation of steam. The product burns with a bluish white flame and does not produce smoke, hence, it is smokeless and free from moisture, clean and a high-carbon fuel, a fuel every consumer desires. Not a furnace would have to be altered in order to successfully use a product of this quality. The railroad locomotives could

successfully use it. It is lighter in weight than coal, but it is much higher in heating value in proportion to its weight.

In the use of one ton of ordinary bituminous coal, the process produced in practice approximately 22,500 feet of 320 B.t.u. gas with the gas leaving the generator below 300° F., and a by-product of 1,460 pounds of distilled coal. The coal used in this test contained approximately 30 per cent. volatile and cost $2.50 f. o. b. cars Chicago, while the 1,460 pounds of smokeless fuel displaced approximately 1,400 pounds of Pocahontas coal which costs the small dealers in car lots, $5.50 per ton f. o. b. cars, and which they retail in ton lots at $7.00 to $7.50.

Should the manufacturer who now consumes fifty tons of bituminous coal per day adopt this method, he would produce approximately the following results:

The average coal consumption is below 50 per cent. efficiency or at the point of combustion, fifty tons of 12,000 B.t.u. coal would generate 600,000,000 heat units at 50 per cent., and if this coal cost $2.25 per ton, f. o. b. cars, the total fuel cost would be $112.50 per day. To displace the heat required by combination gas they would use in gas generation and distillation approximately ninety tons of bituminous coal, which would generate 22,500 cubic feet of 320 B.t.u. gas per ton, or 648,000,000 heat units in gas and this gas can be applied on the basis of 90 per cent. efficiency at the point of combustion. Hence the gas from the volatile in ninety tons of coal will displace the heat as produced by consuming the total value of fifty tons of coal, and in the process of generating the gas, produce sixty-three tons of smokeless fuel, which has a wholesale value of $4.00 or a retail value of from $6.50 to $7.50 per ton.

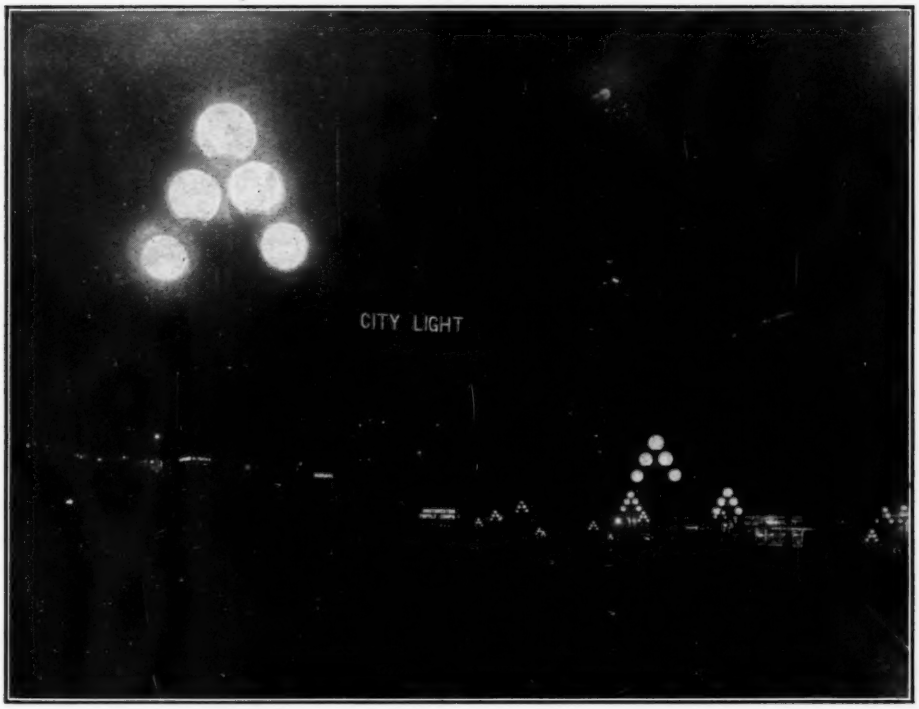
Operation.

63 tons of distilled coal .....@$4.00 f. o. b. cars plant.		$252.00

Operating Expense.

90 tons of bituminous .....@$2.25	$202.50		
Labor and Operating expense .....@	.25	22.50	
Depreciation	.10	9.00	
Interest on investment	.05	5.00	238.00
Total daily net profit.....			$ 13.50
Add to this the cost of 50 tons of coal per day as now being consumed, labor, etc., which will show the net saving as follows:			
50 tons @$2.25			$112.50
Labor, 50 tons @25 cents.....			12.50
Total daily saving.....			$148.50

It is no doubt difficult for the average manufacturer to understand how he could save $13.50 more per day than his present method costs him, but if he will study the commercial value of the by-products present in the volatile matter in the coal, he will appreciate the fact that he is now converting this value into smoke, thereby resulting in a great loss of efficiency, and be willing to co-operate in the development of this process for the solution of the smoke nuisance, and for the economical utilization of coal.



ORNAMENTAL LIGHTING IN SEATTLE

NITROGEN-FILLED TUNGSTEN CLUSTER LAMPS

THE lighting department of the city of Seattle, thru its superintendent, J. D. Ross, recently installed the new system of nitrogen-filled tungsten street lights. For the ornamental lighting system, as shown in the accompanying photographs, there are 1,692 cluster lighting poles of this type, of which 1,179 carry five lamps each, 377 three lamps each and 137 one lamp each. The total extent of the streets lighted by this system is twenty-five miles.

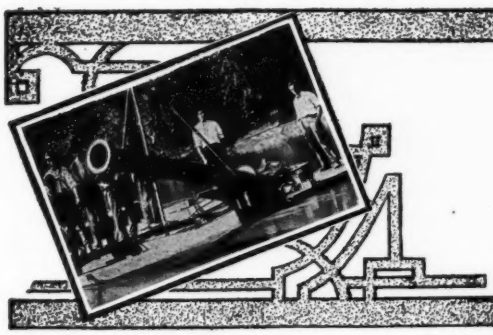
The lights used on the poles shown in the illustrations are from 50-watt, 8-volt, 80-c.p. lamps. Each pole carries a 250-watt 125-volt to 8-volt transformer in its base. The advantage of this system of distribution is that it makes possible the use of a low voltage type of lamp, which, on account of the shorter and sturdier filament, gives a much longer useful life.

Before the nitrogen-tungsten was introduced, an older type of 8-volt tungsten lamp was used on these poles, and the average life of this lamp for the past two years has been 4,100 hours. In a test of forty nitrogen lamps installed December 10, 1913, five burned out up to April 7, 1914, after burning 1,620 hours, and of these two were broken, so that it is anticipated that the nitrogen lamp will be nearly as durable as the older lamp.

The globes used are opal glass and give almost perfect diffusion and the light from the nitrogen lamps is notice-

ably whiter than that from any of the other lamps on the street. With five 80-c.p. lamps per pole and the poles spaced at 80 and 90 feet, the illumination on the street is more than ample.

This same type of lamp is used on "goose-neck" fixtures on the series lighting circuits that supply the outlying districts of the city. A larger unit of the same type is now being tried out to take the place of the series arc lamps which have been used heretofore. This larger lamp gives 600-c.p. and is far superior to an arc lamp in amount and distribution of light. If it proves sufficiently durable it will probably be adopted as standard, as the smaller unit of the same type has been adopted. These 600-c.p. lamps are now in use and are simply elegant, to use the expression of Mr. Ross.



EDITORIAL

PROTECTING THE PEOPLE

The newspapers of Birmingham, Ala., have had full reports of the conferences between the city commissioners of that city and the officials of the gas company over an offer of the latter to furnish the city and its citizens with by-product gas with a minimum of 525 heat units at rates, reducing as the total consumption in the city increases, from 75 cents to 50 cents per 1,000 cubic feet. The present rate is 95 cents with certain small discounts. The new rates provide for a sliding scale according to individual consumption, so that a large consumer gets a rate some 15 cents less than the above rates. The present standard of quality of the mixed coal and water gas now furnished is 575 B.t.u.

Taking account of the difference in quality, it has been computed that the citizen, on the assumption that a reduction of one step in the rate was made each year, would save in six years nearly $1,600.000.

The company's offer did not include a payment to the city treasury, and, the city commissioners, considering the condition of the city treasury and the fact that the operations of the company in the city's street place on the city a burden of expense for inspection and for street repairs and increased cost of street construction, required a payment of this sort.

The contention of the company that it could not afford to make this payment at the rates offered was supported in part by the consulting engineer of the city, and a compromise proposition was finally made which would increase the rates offered by the company by 1 cent each and would require the company to pay the city 2 per cent. of its gross receipts from its gas business. The tax would thus be divided between company and consumers, but when the lowest rate was reached would all be paid from the 1-cent increase in rate. This plan would give the city more than $100,000 in six years on the estimate above quoted, and would still save the consumers of gas in the city nearly $1,500,000 in that period.

Two of the commissioners refused to consider the proposed increase in rate, demanding that the company pay the entire 2 per cent. on the ground that they would protect the citizens from an indirect tax of this nature.

The company refused to pay the entire tax and announced its intention of continuing the present rates and supply of gas during the remaining seven years of its present contract.

The inquiry most pertinent under this statement, made up from the newspaper reports and interviews with officials and engineers, is this: Is the refusal of an offer which will save the consumers of gas, say $1,500,000, because the company refuses to pay the city some $100,000 during the time of the contract, a protection of the citizens in any sense in which that term can be used?

The ultimate rates offered are the lowest yet offered in any city in this country for manufactured gas for all purposes, and, when the difference in quality is taken into account, are lower than those in any other city, except Indianapolis.

MUNICIPAL MOTOR CAR CONSTRUCTION

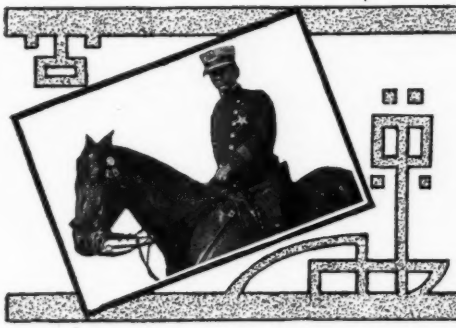
The article entitled "Chicago Builds Motor Cars," which appeared in the June issue of MUNICIPAL ENGINEERING, has aroused some comment as to the economy of a practice of the kind described when applied as a policy to cities in general.

Some very decided views have been expressed upon the subject, the consensus of opinion being apparently that any city, no matter what its size or requirements, is not in position to build or assemble its motor-driven equipment at as low a cost as can a manufacturer who confines himself strictly to this class of work. Especially would this be true were the policy extended to cover fire apparatus as well as ambulances, patrols and motorcycles. Even when all parts are bought and assembled the cost of the work is regarded as prohibitive when the matter of efficiency and ultimate service is taken into consideration.

The truth of this fact is well borne out when it is considered that a few years ago fire apparatus builders started out by buying regular pleasure car and commercial truck chassis and mounting the auxiliary equipment upon them. The comparatively low cost at which it is possible for these manufacturers to supply their equipment made it particularly attractive to many cities, but the records of the fire departments, for instance, where these machines have been in service, prove conclusively that this practice, altho carried on by a factory, was costly, not only to the buyer, but to the manufacturer. It was found that such equipment was not sufficiently strong to withstand the hard service demanded of it, and as a result the breakage of crank shafts, cam shafts, wheels, axles and other vital parts, which were never designed for high strain, has been responsible, not only for an unusually high maintenance cost, but for a poor and inefficient service as well.

It is true that some manufacturers of high-grade fire apparatus are also manufacturers of pleasure cars, but it will be seen that in most such cases there has not been an effort to adapt the lighter equipment to the requirements of the heavier service.

In view of all the facts bearing upon the subject, it would seem wise for any city to give the most careful possible consideration to all the factors entering into the problem before adopting and putting into effect any plan for building or assembling its own equipment which will result in a high cost and an unsatisfactory operating service eventually.



QUESTION DEPARTMENT

Non-Corrosive Metal for Spraying Nozzle Wanted

We herewith have a question for your Questoni Department:

WANTED—A metal that will take the place of brass for nozzle to be used for spraying purposes in an irrigation system that will not be much more expensive than brass and which will corrode less. B., Chicago, Ill.

Have our readers anything to suggest?

Waterproofing Paint for Cement Block House

Please send me the address of some good waterproofing company. I want to paint my house outside with it. My house is of cement block. I would have about 1,200 square feet to cover. N., ———, S. D.

The Antakwa Co., Chamber of Commerce, Chicago, Ill., H. W. Johns Manville Co., New York, the Sandusky Portland Cement Co., Sandusky, O., or the Trus-Con Laboratories, Detroit, Mich., can probably supply what is wanted. Others from whom such materials can be obtained are Samuel Cabot, Boston, Mass.; Smooth-on Mfg. Co., Jersey City, N. J.; Aquabar Co., Philadelphia, Pa.; Ceresit Waterproofing Co., Chicago, Ill.; Geo. W. DeSmet, Chicago, Ill.

How to Build Concrete Houses

Could you advise me where I can obtain some information concerning poured concrete houses, especially small, inexpensive houses, to be used as miners' dwellings?
M., ———, N. M.

Possibly the Edison poured concrete house is in mind. This has not been developed as a very practical method, altho the walls for concrete houses are made monolithic or hollow by the use of movable forms which can be used again and again, in raising the wall until to the desired height.

The Association of Portland Cement Manufacturers, Philadelphia, Pa., the Universal Portland Cement Co., Chicago, Ill., the Atlas Portland Cement Co., New York City, the Sandusky Portland Cement Co., Sandusky, O., all have publications giving more or less information and instruction concerning methods of building concrete houses.

Information can also be obtained from the manufacturers of wall forms, clamps, molds, etc., such, for example, as Reichert Mfg. Co., Milwaukee, Wis.; Insley Mfg. Co., Indianapolis, Ind.; Trussed Concrete Steel Co., Youngstown, O.; Concrete Sand & Stone Co., Youngstown, O.; J. H. Sullivan, Grand Rapids, Mich.

Any of our readers specially interested in the matter will be put into communication with our correspondent.

Wording of Park Signs

Can you give any suggestions for the appropriate wording of signs to be placed in public parks, S., South Orange, N. J.

Suggestions for striking and original signs for park purposes are invited from our readers. For example, one city has small signs set on steel pins which are readily movable from place to place, which have simply the word "Please" on them. These signs are set up where paths are being worn, where grass is being cultivated or elsewhere when, for any reason, the public should for a time be kept off a space or a line. They are removed when no longer needed.

Who Makes Corrugated Tampers?

Please give me the name of any firm advertising or selling corrugated tamps.
F., Greenville, Tex.

The Lourie Manufacturing Company, Springfield, Ill., makes a tamping machine in which various forms of tampers and cutters are used. The Barber Asphalt Paving Company, Iroquois Works, Buffalo, make paving tampers. Warren Brothers Company, Boston, Mass., can also supply them. Harold L. Bond Company, Boston, Mass., make the Andrews concrete tamper. W. H. Anderson Tool and Supply Company, Detroit, Mich.; Ransome Concrete Machinery Company,

Dunellen, N. J.; Dunn Manufacturing Company, Pittsburg, Pa.; Union Elevator and Machine Company, Chicago, Ill., can also supply what is wanted.

Ordinance Prohibiting Free Lunch with Sale of Liquors

Have you any reference to any city ordinances prohibiting the giving away of a free lunch in connection with the sale of intoxicating liquors, under license?

L., City Attorney, ———, Wis.

Can our readers refer us to any ordinance on this subject which has stood the test? This is one form of a difficult question and the tendency has been against the validity of such ordinances in the absence of constitutional or legislative action to exactly the same effect.

How to Get an Education in Municipal Engineering

I am employed in the water department of this city, where my duties, besides looking after the meter system, consist of helping the engineer survey and run levels, and inspecting drainage and plumbing. I have every advantage offered me in the way of technical books, the methods employed in surveying, etc., and I have come to the conclusion that I am to study the profession of municipal engineering. I was educated in Scotland, being a graduate of Kings College, Aberdeen, Scotland, and I firmly believe that I can make good. What I want is your suggestions as to the best methods to pursue, such as taking up a regular correspondence course, or studying what is now at hand. I believe there is a good field for good men in such work, and if you can offer me any suggestions, which no doubt with your vast experience you can, they will be highly appreciated and acted upon.

C., ———, Iowa.

The nature of the education should depend upon the age, ambition and abilities of the student. One can greatly improve his condition as an employe by following a correspondence course, and even give himself a basis for fairly good success in design and construction of new work, but for high-class professional engagements the fullest preparation is becoming more essential each year, and this can be obtained only by attendance at a good technical school supplemented by the best experience obtainable.

The study of books while in subordinate positions is an excellent preparation for the technical school work, especially if it is made under some guidance from an expert. The ordinary text-book used by a correspondence school is rather elementary and is liable to be superficial, but it lays out the course of study, and, if supplemented by thoro reading of the best books in the respective lines is of material aid to the earnest student. If he keeps in mind the possibility of attendance at the technical school, even if that attendance must be intermittent, and keeps in touch with the work and the teaching force in it, the rapidity and the soundness of the advancement will be increased.

Ornamental Lights at Cost of Abutting Property

Please advise if you know of any city where ornamental street lighting standards have been installed as a local improvement, the cost of installation being assessed against the owners of property abutting on the street improved by such ornamental lighting system.

Also please advise if you know of any city where the cost of lamp standards for ornamental street lighting has been included in the cost of city work, or perhaps, as a part of a public movement and paid for by assessment charged against the abutting property.

D., Mayor, ———, Ill.

California cities and even unincorporated towns and country districts can instal lighting systems by assessment on the property, as described in MUNICIPAL ENGINEERING for June, vol. xlvi, p. 510. Possibly the DeKalb, Ill., installation, shown on p. 385 of the same volume was so paid for.

Billings, Mont., forms lighting districts and assesses the cost on the property, as described in vol. xliv, p. 15.

Will our readers cite other cases within their knowledge?

In some cases ordinances are passed making the movement a public one, but in many of these cases the stubborn owner or tenant could not be forced to pay in case he refused, the movement being somewhat in advance of statutory provisions.

In cities where the method of assessment is not possible the installation is made by agreement. In some cases the lighting company puts in the lamps and charges the property owner or lessees a certain rate for the light, as in St. Joseph (see vol. xliv, p. 51) and Indianapolis in an earlier volume.

In other cities the property owners or occupants pay for the installation of the ornamental lamps by agreement and the city furnishes the light. This arrangement is easily made when the city owns the lighting plant, but is in operation with private plants also, as in Waterloo, Iowa (see vol. xliv, p. 41), Topeka, Kan. (vol. xlvi, p. 282), Fargo, N. D. (vol. xliii, p. 119), Baltimore, Md. (vol. xliii, p. 292).

The terms of installation and other data regarding some seventy cities and towns are given in vol. xliii, p. 309. The lighting company made the installations and the merchants pay for the light in seven cases and the owners in one case. The merchants pay the whole cost in three cases, with some help from the city in a fourth case. The owners pay for the lamps and the tenants for the light in three cases. The owners pay for lamps and the city for the light in

six cases, the tenants joining with the owners in four other cases. The merchants pay for the lamps and the city for the light in four cases. The company installs the lamps and the city pays for the light in two cases. The city pays the whole bill in thirteen cases.

Metric Conversion Tables

Who publishes tables giving the equivalents of the metric system and British measures and vice versa, down to thousandths of inches and hundredths of millimeters; also tables giving decimal equivalents of parts of an inch and millimeter equivalents of parts of an inch? In short, we want tables giving the equivalents of the metric system in the British measure system and vice versa.

B., New York.

Van Nostrand's "Table Book for Civil and Mechanical Engineers" (50 cents), is probably what is wanted.

Individual Septic Tanks

Do you have any data on septic tanks for individual homes?

What I desire, if possible, are data showing dimensions, etc., or information as to where the same may be obtained. Any help, along the above lines, that you can give me will be much appreciated. L., ———, Cal.

Several articles in MUNICIPAL ENGINEERING give instructions on this problem. One by R. Winthrop Pratt in vol. xlii, p. 229, gives plans and descriptions and estimates of cost. The Russell system is noted on p. 347. A brief article with references to earlier articles will be found in vol. xli, p. 42, and a long list of articles is given in vol. xxxvi, p. 241.

Municipal Swimming Pools

Have you any information about municipal swimming tanks; that is, what cities are operating same?

It seems to me that swimming interests the average boy as much as anything, and I wish to look into the matter.

Any advice that you can give me will be greatly appreciated.

C., Decatur, Ga.

Boston, New York, Chicago, Rochester, N. Y., are among the cities having public swimming pools in operation the year round. There are many cities which make provision for swimming pools in summer under proper supervision and care, such as Cincinnati, St. Louis, Milwaukee, Indianapolis, Cleveland, etc.

Will our readers add names to these lists?

Parking Down Center of Wide Street

The city of Negaunee is thinking of paving a wide street and leaving a narrow strip in the center to be planted or sodded. Do you know of any city that has a street paved in such a manner?

E. G. STERLING, City Engineer.

There are many cities which have such streets, some of them boulevards and some simply residence streets. The City of Indianapolis, Ind., has a number of streets so laid out for short distances. Some Chicago, Ill., boulevards have used this plan. Detroit, Mich., has used the plan to some extent. Sometimes the street railway tracks are laid thru the central parking strip, as on some streets in Boston, Mass.; Rochester, N. Y., and Birmingham, Ala. See the short street in the article on Baltimore (Roland Park) pavements on another page in this issue of MUNICIPAL ENGINEERING.

This plan works quite well in some cases, but several objections can be made to it, especially as applied to fairly level areas. Thus each of the driveways should be about 18 feet wide, to allow for passage with vehicles standing at the curb, making a total width of paving of 36 feet, whereas a single driveway in the center of a residence street need not be more than 28 feet. The curb around the central grass plot is an extra cost. Unless the park department assumes the care of these central grass plots, their maintenance depends upon the interest taken in them by the residents and they are very irregular in appearance. The park department is likely to object to assuming the work of taking care of the plats, because it is quite expensive, as compared with the cost of caring for like areas in parks. Where droughts are probable, the watering of these plats is not easy.

For these reasons some cities have abandoned this form of improvement and prefer a single driveway in the center, sidewalks at or near the lot lines and wide tree-planted lawns between street curb and sidewalk.

Such a book as Robinson's "Width and Arrangement of Streets" ($2) gives valuable instruction on the general planning of street areas.

Ordinance Regulating Moving Picture Shows

Will you please send me a copy of an ordinance regulating the operation and conduct of moving picture shows, covering the matter of examination and licensing of the operators of the machines. B., ———, N. M.

The New York motion picture ordinance is the most complete one at hand. It reads as follows:

352a. Motion pictures shall be deemed a display on a screen or other device whereby pictures are displayed of characters or objects in motion, whether or not accompanied by music, lecture, recitation or song.

352b. A motion picture theatre shall be deemed any public hall or room in the City of New York in which motion pictures are exhibited, in which the seating capacity does not exceed 600, and in which there is no stage or scenery.

An open air motion picture theatre shall be deemed any public place or space in the open air in the City of New York in which motion pictures are exhibited, and in which there is no stage or scenery.

The Mayor shall appoint such Inspectors as shall be necessary to carry out the provisions of this ordinance. They shall be known as "Motion Picture Theatre Inspectors," and shall be paid such compensation as shall be fixed by the Board of Aldermen on recommendation of the Board of Estimate and Apportionment.

352c. The Bureau of Licenses shall issue all motion picture licenses granted by the Mayor, and by authority of the Mayor shall regulate and control all motion picture theatres, provided:

1. Applicants for motion picture licenses shall file plans and specifications of the motion picture theatre with the Bureau of Buildings of the Borough in which the motion picture theatre is to be situated, and must file a copy of such plans and specifications duly approved by the Superintendent of Buildings with the aplication for the license, which application shall be made to the Bureau of Licenses on blanks furnished by it for that purpose.

2. The Bureau of Licenses shall, without delay upon the request of an applicant, pass upon the location of the motion picture theatre and upon the character of the applicant requesting the license.

3. The Bureau of Licenses shall request the Fire Department, Bureau of Buildings, Department of Water Supply, Gas and Electricity, and Department of Health to inspect said theatres, and the said Departments shall file in the Bureau of Licenses, within ten days, detailed written reports, which shall include a statement of any violations of law, ordinances, rules and regulations, and any dangerous conditions. Upon the failure of any of said departments to file detailed written reports in reply to the request of the Bureau of Licenses, the said Bureau may disregard said Department, and, in its discretion, may issue a license.

4. Until the provisions of this ordinance shall have been complied with, no license shall be issued.

252d. 1. Plans—Before the erection, construction or alteration of a building, or part thereof, to be used as a motion picture theatre, there must be filed with the Superintendent of Buildings complete plans and detailed statement as set forth in section 4 of the Building Code. The plans must show clearly and fully the location and width of all exits, passageways, stairs, fire escapes, aisles, etc.; arrangement of seats, size of floor beams, walls, supports, etc.; the location and construction of the inclosure for the motion picture light and machinery, and for other similar apparatus, a diagram of the lot or plot, showing outlets from all exits, and also such other statements, plans or details as may be required by the Superintendent of Buildings.

2. Prohibition — Motion picture theatres shall not be constructed in frame buildings within the fire limits, nor in hotels, tenement houses of lodging houses; nor in factories or workshops, except where the theatre is separated from the rest of the building by unpierced fireproof walls and floors; and in no case shall they be constructed or operated above or below the ground floor of any building.

3. Exits and Courts—All such buildings must be provided on the main floor of the treatre with at least two separate exits, one of which shall be in the front and the other in the rear, both elading to unobstructed outlets on the street. Where the main floor of the theatre accommodates more than 300 people there shall be at least 3 sets of exits. The aggregate width in feet of such exits shall not be less than one-twentieth of the number of persons to be accommodated thereby. No exits shall be less than 5 feet in width and there shall be a main exit not less than 10 feet in total width.

In all such buildings to be erected or to be altered so as to be used for a motion picture theatre, if unobstructed exit to a street cannot be provided at the rear of such buildings, as herein specified, either an open court or a fireproof passage or corridor must be provided from rear exit to the street front, of at least the following width: 4 feet in the clear for theatres accommodating 100 persons or less; for every additional 100 persons the width to be increased 8 inches. Such passage must be constructed of fireproof material and must be at least 10 feet high in the clear. The walls forming such passage must be at least 8 inches thick, of brick or other approved fireproof material, and if there be a basement the wall on the auditorium side should either run 1 foot below the cellar bottom or may be carried in the cellar on iron columns and girders properly fireproofed according to sections 106 and 107 of the Building Code.

The ceiling of said passage, and if there be a basement, the flooring, must be constructed according to section 106 of the Building Code.

If unobstructed rear exit or exits to a street are provided, the said exit or exits must be of the same total width required

for the court or passage above mentioned.

Said passages and exits to the street, as above, must be used for no other purposes except for exit and entrance and must be kept free and clear.

The level of the open court or passage at the front of the building shall not be greater than one step above the level of the sidewalk, and the grade shall not be more than 1 foot in 10, with no perpendicular rises.

All exit doors must be unlocked when building is open to the public. They must be fireproof and made to open outwardly and so arranged as not to obstruct the required width of exit or court when opened. All doors leading to fire escapes must be not less than 40 inches wide in the clear, and shall be located at the opposite side or end of the gallery from other exit doors.

4. Galleries and Stairs—A gallery may be permitted, but it shall not include more than 25 per cent. of the total seating capacity of the theatre. Entrance to and exit from said gallery shall in no case lead to the main floor of the theatre, and the gallery shall be provided with a stair or stairs equipped with handrails on both sides. Stairs over 7 feet wide shall be provided with centre handrail. The risers of the stairs shall not exceed 7¾ inches, and the treads, excluding nosings, shall be not less than 9½ inches. There shall be no circular or winding staircases.

The total width of the stairs shall not be less than 8 feet in the clear where the gallery accommodates 150 people; for every 50 people less than 150 which the gallery accommodates said width may be reduced 1 foot.

Stairs shall be constructed of fireproof material, and such material and the bearing capacity of such stairs shall be approved by the Bureau of Buildings.

Galleries must also be provided with at least one line of fire escapes leading to an open court, fireproof passage or street, without re-entering the same or any other building.

If the fire escape leads to a point in the court nearer the street than any exit, there must be a width of not less than 4 feet in the clear between the outer edge of the fire escape and the outer wall of the court.

5. Fire Escapes—All fire escapes must have balconies not less than 3 feet 4 inches in width in the clear and not less than 4 feet 6 inches long, and from said balconies there shall be staircases extending to the ground level with a rise of not over 7¾ inches and a step not less than 9½ inches, and the width of stairs must not be less than 3 feet 4 inches.

6. Auditorium and Other Rooms—If the walls of the auditorium contain wood studs, they shall be covered with either expanded metal lath or wire mesh, and plastered with three coats of first-class plaster, or may be covered with metal on ½-inch plaster boards. The joints shall be properly filled with mortar.

The ceilings of all such rooms shall be plastered with three coats of first-class plaster or wire mesh or metal lath, or covered with one-half inch plaster boards, and plastered or covered with metal.

If there be a basement or cellar the ceiling under the auditorium floor must be plastered with three coats of first-class plaster or wire mesh or expanded metal lath, or may be covered with metal on one-half inch plaster boards.

The basement or cellar under the auditorium shall be kept free and clear except the space used for the heating apparatus, for machinery connected with the theatre, and for coal.

7. Construction of Booths—Apparatus for projecting motion pictures shall be enclosed in a booth or enclosure constructed so as to be fireproof, in accordance with the specifications of chapter 756 of the Laws of 1911. The booth shall be equipped with a vent flue, as prescribed in section 352F, paragraph 3 of this ordinance. Booths shall contain an approved fireproof box for the storage of films not on the projecting machine. Films shall not be stored in any other place on the premises; they shall be rewound and repaired either in the booth or in some other approved fireproof enclosure.

Where miniature motion picture machines are employed in connection with private exhibitions the requirements of the above paragraph may be so modified as to permit, instead of the regulation booth, an approved fireproof box, unventilated, and of a size only sufficient to properly enclose the machine.

8. Gradients—To overcome any difference of level in and between corridors, lobbies and aisles, gradients of not over 1 foot in 10 feet, or steps having a rise not over 8 inches and a width of not less then 10 inches must be used.

9. Aisles—All aisles in the auditorium and gallery must not be less than three feet wide in the clear. No aisle, passageway or space in the rear of the auditorium shall be obstructed by any camp stool, chair, sofa or settee, nor shall any person be permitted to sit therein.

10. Chairs—All chairs in the auditorium except those contained in the boxes, must not be less than 32 inches from back to back and must be firmly secured to the floor. No seat in the auditorium shall have more than seven seats intervening between it and an aisle. The space occupied by each person shall be separated from the adjoining space by means of an arm or other suitable device.

11. Signs Over Exits—Over every exit there must be painted on the inside in

letters not less than six inches high, the word "Exit" in legible type, and one red light or illuminated sign must be placed inside over each exit, and illuminated while the audience is present.

12. Floor Loads—The flooring of that portion of the building devoted to the uses or accommodation of the public must be of sufficient strength to bear safely a live load of 90 pounds per square foot.

13. Toilets—Toilets separate for sexes must be provided.

14. Fire Apparatus—Portable fire apparatus shall be provided of the following kind and number: Ten-quart capacity buckets, painted red with the word "Fire" in black, the letters 4 inches high, to the number of six for places seating less than 300 without a gallery, and two additional if there be a gallery; to the number of ten in places seating over 300 persons, and four additional if there be a gallery. There shall be two buckets containing dry sand kept in the operating booth; approved fire extinguishers of 2½ gallon capacity, of the regulation Fire Department pattern, of which two shall be on the main floor and two in the gallery, if there be one, and one in the operating booth; 4-pound flat-head axes, two of which shall be on the main floor and two in the gallery, if there be one.

352c. 1. Lighting—Every portion of a moving picture theatre, including exits, courts and corridors, devoted to the uses or accommodation of the public shall be so lighted by electric light during all exhibitions and until the entire audience has left the premises, that a person with normal eyesight should be able to read the Snellen standard test type 40 at a distance of 20 feet and type 30 at a distance of ten feet; normal eyesight meaning ability to read type 20 at a distance of twenty feet in daylight. Cards showing types 20, 30 and 40 shall be displayed on the side walls, together with a copy of this paragraph of the ordinance.

2. Heating—When the temperature of the outdoor air is below 60 degrees F. the air in the theatre while an audience is present shall be maintained at a temperature not lower than 62 degrees F. nor higher than 70 degrees F.

If gas stoves, oil stoves or other apparatus throwing off products of combustion are used to heat motion picture theatres said products of combustion must be carried to the outside air by means of a fireproof flue or flues.

No radiator shall be placed in the aisles so as to lessen the width below the minimum requirement.

3. Ventilation — Motion picture theatres having less than 200 cubic feet of air space for each person, or motion picture theatres in which the outside window and door area is less than one-eighth of the floor area, shall be provided with artificial means of ventilation which shall supply during the time the audience is present at least 500 cubic feet of fresh air per hour for each person.

Motion picture theatres having more than 200 cubic feet of air space for each person, or which have outside windows and doors, the area of which is equal to at least one-eighth of the floor area, shall be provided with artificial means of ventilation, which shall be in operation when the outside temperature requires the windows to be kept closed, and which shall supply during the time the audience is present, at least 500 cubic feet of fresh air per hour for each person. When the artificial ventilation is not in operation ventilation by means of open doors and windows shall be sufficient to provide each person with 500 cubic feet of fresh air per hour.

Motion picture theatres having more than 1,000 cubic feet of air space for each person and having outside windows and doors the area of which is equal to at least one-eighth of the total floor area, shall not be required to have artificial means of ventilation; provided the air is thoroughly changed by freely opening doors and windows immediately before the admission of the audience, and at least every four hours thereafter.

No part of the fresh air supply required by any of the above paragraphs of this section shall be taken from any source containing vitiated air.

The area of outside doors and windows shall mean the area capable of being freely opened to the outside air for ventilation purposes.

When fresh air is supplied by means of ventilating openings, at least one inlet shall be situated at one end of the room, and at least one outlet at the other end of the room. Where exhaust or inlet fans are necessary, at least one of such fans shall be placed in an outlet opening. The inlet opening or openings shall be placed in the floor or within 2 feet from the floor, and the outlet opening or openings in the ceiling or within 2 feet of the ceiling. The inlet openings and their surroundings shall be kept free from dust so that the incoming air shall not convey dust nor stir up dust as it enters.

During the time the audience is present, the air in the theatre shall be kept continuously in motion by means of fans to the number of at least 1 to every 150 persons. Such fans shall be placed in positions remote from the inlet and outlet openings. No person shall be exposed to any direct draft form any air inlet.

The booth in which the picture machine is operated shall be provided with an opening in its roof or upper part of its side walls, leading to the outdoor air. The vent flue shall have a minimum cross sectional area of 50 square inches and

shall be fireproof. When the booth is in use, there shall be a constant current of air passing outward thru said opening or vent flue at the rate of not less than 30 cubic feet per minute.

352f. Motion picture theatres must be kept clean and free from dust.

The floors, where covered with wood, tiles, stone, concrete, linoleum, or other washable material, shall be mopped or scrubbed with water or swept with moisture and soap, or water and some other solvent substance, at least once weekly.

Carpets, rugs and other fabric floor coverings shall be cleaned at least once daily by means of suction cleaning, beating or dustless sweeping. Curtains and draperies shall be cleaned at least once monthly by suction cleaning, beating or washing. Cornices, walls and other dust-holding places shall be kept free from dust by washing or moist wiping. The wood and metal parts of all seats shall be kept clean. Fabric upholstering of seats and railings and other fixed fabrics shall be cleaned by suction cleaning, or other dustless method, at least once monthly.

352g. Thru its Motion Picture Inspectors, as provided in subsection b of this ordinance, the Bureau of Licenses shall inspect, subject to the authority of the Mayor, the character of exhibitions in motion picture theatres, and shall report to the Mayor any offense against morality, decency or public welfare contained in said exhibitions.

352h. All provisions contained in this ordinance shall apply to existing places of entertainment where motion pictures are exhibited under a common show license, except those provisions of subsection d designated as Nos. 1, 2, 3, 4, 5 and 6, but the Bureau of Licenses shall have power in its discretion to enforce the provisions of said paragraph 3 of section d as to exits and courts.

352i. Existing places of entertainment seating 300 persons or less, where motion pictures are exhibited in conjunction with any other form of entertainment, must comply, before a reissuance of its license, with the provisions of section 109 of the Building Code, covering theatres seating more than 300 persons. But if such existing place of entertainment discontinue all other form of entertainment except the exhibition of motion pictures, it may be licensed in accordance with the provisions of subsection h.

352j. With the exception of paragraph 7 of subsection d, subsections a to f inclusive, and subsections h, i, k and l of this ordinance shall not apply to motion picture exhibitions with or without charge for admission, conducted under the direct management of educational or religious institutions, nor to motion picture exhibitions without charge for admission given or held not more than once a week in private residences or bona fide social, scientific, political or athletic clubs. Before motion pictures shall be exhibited in any of the places above mentioned, there shall be obtained from the Bureau of Licenses a permit for such exhibition. Before granting such permit, the Bureau of Licenses shall cause to be inspected the premises where such proposed exhibition will be held, and shall grant the permit if in its judgment the safety of the public be properly guarded, and provided that for an audience of more than 75 people all chairs or seats shall be securely fastened to the floor or fastened together in rows.

352k. The Bureau of Licenses at its direction shall specify the seating capacity for each open-air motion picture theatre. Aisles must be 4 feet wide, or wider, in the discretion of the Bureau or Licenses. At least two separate exits, remote from each other, shall be provided, and no exit shall be less than 5 feet in width. For every 25 persons to be accommodated in excess of 300, the total width of exits shall be increased one foot. All exits must be indicated by signs and red lights and the doors must open outwardly. Seats must be stationary, with backs 32 inches apart, and so arranged that no seat shall have more than seven seats intervening between it and an aisle. The floor must be constructed either of wood with sleepers or of concrete, and must extend at least 5 feet from the seats on all sides, provided, however, that in the discretion of the bureau of Licenses, a gravel floor may be substituted for wood or concrete. Chairs must either be securely fastened to wood or concrete floor or all chairs in a row must be fastened to one frame, except that where refreshments are served, tables and unattached chairs or benches used with them may be permitted.

352l. Only subsections a, b, c, d, paragraphs 7 and 13, and g, j and k of this ordinance shall apply to open air motion picture theatres.

352m. 1. It shall be unlawful for any person, firm or corporation to show or exhibit any motion pictures in any licensed place of public amusement, in any theatre, concert hall, motion picture theatre or in any open-air motion picture theatre without first having obtained a permit therefor issued by the Bureau of Licenses as herein provided. Every day's exhibition in any licensed place of public amusement without such permit therefor shall be deemed a distinct and separate violation of this ordinance.

2. The Bureau of Licenses shall not grant a permit to exhibit any motion picture until an application in writing shall have been made therefor to the Bureau of Licenses, nor until the plates,

films, rolls or other like apparatus by or from which such motion picture is shown or produced shall be inspected by a censor or censors duly authorized by the Department of Education from the teachers, examining or supervising staff thereof for the work of censoring motion pictures, nor until the motion picture itself shall be seen by the censor or censors, nor until a letter of approval from the Department of Education fully describing said motion picture shall have been received by the Bureau of Licenses.

In case such picture is approved by the Department of Education, the Bureau of Licenses shall issue a permit in writing and in such form as the Bureau of Licenses shall prescribe.

3. If any motion picture for the exhibition of which an application for such permit is made, is an obscene, indecent, immoral or impure motion picture which would tend to the corruption of the morals of youth or others, or if it pictures any crime, any murder, suicide, robbery, hold up, stabbing, assaulting, clubbing or beating of any human being in such detail as to offend the sense of morality or decency, it shall be the duty of the Bureau of Licenses to refuse such permit. Otherwise it shall be the duty of the Bureau of Licenses to grant such permit.

The Bureau of Licenses, however, shall not grant any such permit, unless it has received a letter of approval from the Board of Education, through its agents duly authorized for censoring motion pictures. In case any picture is declared by the censor or censors authorized by the Department of Education to be of such a high degree of educational, moral, spiritual, religious or sacred character as to make it in keeping with the highest ideals of the American Sunday as set forth in the laws of New York, the Bureau of Licenses shall indicate that fact upon the permit by the use of these words: "Approved for Sundays and week days."

Only such motion pictures as are thus approved by the Department of Education for Sunday use shall be used in such exhibitions of motion pictures as are permitted by law on Sunday.

4. In case the Bureau of Licenses shall refuse to issue such permit because of the failure to receive the aforesaid approval from the Department of Education, the applicant may appeal to the Mayor. Such appeal shall contain the statement of the grounds for the refusal of the Bureau of Licenses to grant a permit and shall be presented to the Mayor in the same manner as the original application to the Bureau of Licenses and shown and exhibited in the same manner as before the censors of the Department of Education. If any motion picture for the exhibition of which such appeal is made to the Mayor for permit is an obscene, indecent, immoral or impure motion which would tend to the corruption of the morals of youth or others, or if it pictures any crime, any murder, suicide, robbery, hold up, stabbing, assaulting, clubbing or beating of any human being in such detail as to offend the sense of morality or decency it shall be the duty of the Mayor to refuse such permit. Otherwise, after he has secured from the Board of Education a statement of the ground upon which a letter of approval was refused by the censor or censors duly authorized by said Board, it shall be the duty of the Mayor, in case he deems the decision of the Censors of the Board of Education to be erroneous, to grant such permit, and he shall direct the Bureau of Licenses to issue it as ordered by him.

The determination of the Mayor in respect to the appeal for any such permit may be reviewed by writ of certiorari and the provisions of law and of practice in respect to the writ of certiorari to review the determination of an inferior tribunal shall be applicable thereto.

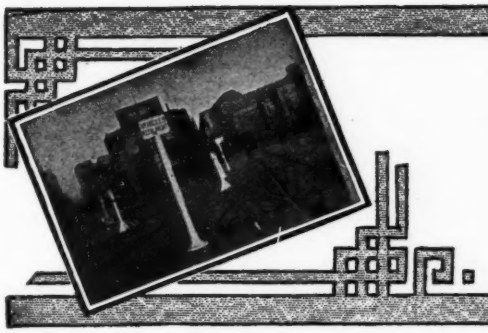
5. The permit provided for in this ordinance shall be obtained for each and every motion picture exhibited in any motion picture theatre, in any open-air motion picture theatre, in every licensed theatre or concert and every licensed place of public amusement, and shall be required in addition to any license now required by any other provision of this ordinance. No fee or tax of any kind whatsoever shall be charged or exacted for such permit.

6. When such permit to show or exhibit a motion picture is once issued to any applicant, such motion picture may be shown in any duly licensed place, provided that such written permit, clearly describing such motion picture is actually delivered to the licensee of such motion picture theatre or other licensed place of public amusement. Any number of transfers of such permit may be made, provided always that such permit is actually delivered to such transferee.

7. The permit provided for in this ordinance shall be posted at or near the entrance of the motion picture theatre or the open-air motion picture theatre or any licensed place of amusement where the motion picture permitted by such permit is being shown or exhibited at such a place and in such a position that such permit can easily be read by any person entering such theatre at any time when such motion is there being exhibited. The exhibition of any motion picture in any motion picture theatre or in any open-air motion picture theatre or any licensed place of public amusement without the posting of such permit therefor shall be considered a violation of this ordinance.

License fees for moving picture theatres are $100 a year and for open-air theatres, $50.

July, 1914



WORKERS IN THE FIELD

The Business Outlook

To the Editor MUNICIPAL ENGINEERING:

Sir—Your editorial in the June issue of MUNICIPAL ENGINEERING, on the "Business Outlook" impresses me as a somewhat optimistic interpretation or analysis of the present situation in business based upon a very broad view of the subject. The point of it seems to be that the present apathy in business is the result of a state of mind rather than of adverse legislation or incorrect administration of existing laws.

The present democratic administration went into office under the most favorable possible auspices. Public sentiment was strongly in favor of a change, and the apparently sound principles and inspiring promises of President Wilson commanded the respect and confidence of the public generally. The program of the administration has been mercilessly carried out and the public has waited patiently for the promised improvement. The reduction in tariff was said to be the most important remedy for the high cost of living and yet the year during which it has already been operative does not indicate even the slightest change in former conditions. The banking reform is generally regarded as a good movement but the proposed trust regulation and the apparent lack of proper attention to the railroad problem supply ample basis for the exercise of caution on the part of business men. It is not possible to foretell just how extensive may be the effect of the legislation still pending.

It is easy to try to console ourselves with the trite statement that business men are influenced by impulse and that poor business is fundamentally due to a state of mind, but one can not endorse such a sentiment without discrediting the intelligence of that great mass of men who operate and control the country's business activities. No one is more anxious to witness an improvement in business than the average business man. If a change in sentiment alone might accomplish this, the return of prosperity would not require a week nor a day. Business men are not so stubbornly opposed to good times as the President's recent expression indicates, and any such analysis of the situation is disappointingly academic.

S., Chicago.

The only argument against the spirit of optimism in the editorial referred to which has occurred to the writer, is one not mentioned by our correspondent. It is the fact that the trade depression is world-wide and is less in this country than elsewhere. But this argument supports the real point in the article, namely that if we will apply ourselves with the same energy to the development of the business in hand that we have heretofore in trying to promote new projects, we will not progress so rapidly, perhaps, but we will not be so apt to discount the future so much and will not need to stop production until the world catches up with our enthusiastic over-development.

Vancouver Garbage Collection and Disposal Ordinance and Methods

To the Editor MUNICIPAL ENGINEERING:

Sir—I notice in your last issue of MUNICIPAL ENGINEERING that you are asking your readers to supply you with any information in the matter of the collection and disposal of municipal wastes. As I was for a number of years in charge of the garbage department in this city, I thought that it might be of some use to the engineer who is making the inquiry, and also to the public as well, to describe our methods here.

The city of Vancouver has a population of 120,000 people and its area is about fifteen square miles. The layout of the city is such that there is an alley in almost every block. This, of course, makes the collection of refuse much cheaper than where everything has to be carried out to the front.

The city owns and operates all its equipment both for the collection and the disposal of all the city wastes.

Some years ago this work was being done by the contract system, but owing

to the unsatisfactory service being rendered to the citizens, the city council of that time very wisely put an end to the contract system, and placed the whole system under civic control. The city purchased the equipment which was owned by the contractor, for which they paid him a fair valuation, and by so doing acted fairly and justly with him. Under the contract system there was continual trouble between the contractor and the people to whom he was rendering the service. This might have been no fault of the contractor. The fault lay more with the city for having let the work out by contract, when they themselves should have kept it under their own control.

The city has now over 70 vehicles in the garbage department, consisting of single-horse carts, double teams, and large motor-trucks. The single carts are used mostly in collecting from the residential districts of the city, the large wagons in the collection of ashes and such like, while the motor-trucks are used in cleaning up the down-town district where the garbage and refuse is heavy.

The garbage is collected once per week in the residential districts, and every day from hotels and the business section of the city. The department will go to any part of the city when called upon, but the party ordering the vehicle has to pay for the charge, which is governed by by-law. From the residential section of the city there is no limit placed upon the amount of garbage that the city will remove, the only restrictions being, that the refuse must be placed in galvanized receptacles which must be kept covered and free from liquids. The garbage is removed free of cost from all residences and the cost is taken from the general revenue of the city. All business houses and such like have to pay the department for any services rendered, according to the amount of work performed.

This city has two destructors in which with an inspector in each district. These districts are subdivided into beats so that each teamster has his own beat to look after, and should any complaint come into the office, the inspector can at once find out who is at fault, as he knows the number of the man working on the beat at the time the complaint came in. The inspectors report daily to the head foreman, who has charge of the whole city under the superintendent. These reports are kept on file in the office for future reference.

There is no department in any city that can be run so smoothly that no trouble comes up, but the main thing that I found while in charge of this work, was to have a system that the cause for the complaint could be detected at once and the remedy immediately applied. Once the citizen sees that the department responds to any complaint, no matter how small, the public begin to place confidence in the department, and very shortly mole hills which would have grown to mountains will disappear altogether.

This city has two destructors in which all the wastes of the city are destroyed. The destructors have given good satisfaction and do their work effectively and without any nuisance. Both the destructors have steam boilers, but little or no use is made of the steam which is generated, the only use being the heating of the buildings and office around the plants. The calorific value of the garbage being low, would necessitate the purchasing of fuel in order to keep a steady supply of steam. With coal at $7 per ton this was considered out of the question.

Doctor Underhill, the medical officer, is a strong believer in the destruction of all city wastes by fire, and it was he who was the chief mover in getting the city to build the first destructor. During my term of office with the city I visited many of the cities in quest of information, after which I became more and more convinced that the doctor had formed the right opinion, in so far as this city was concerned. Each city has problems that belong only to itself, and a system that works well in one city may be of no use in another, consequently each city must be guided by conditions as they present themselves locally.

A clean city should be the pride of all good citizens, as the health of the community to a very large extent depends upon the cleanliness of each and every place within its confines, whether it be public or private property.

In order to get at the proper solution of the garbage problem, the cities must own and operate their own equipment. They must also be prepared to place men in charge who are thoroughly competent to run the department. Ward politics must cease to be the ruling factor in the selection. Then and not until then, can modern methods be adopted.

The system of direct charges for the removal of garbage is not a good one, and should not be resorted to. The operating expense should be charged to the general revenue of the city, or by way of tax levy against property. With the free collection of garbage there is no quibbling about the amount of refuse to be removed, which is always a bone of contention with direct charges.

I am enclosing you a copy of the by-law which governs the garbage depart-

ment in this city, the contents of which are to meet the conditions that exist in this locality.

P. WYLIE,
Vancouver, B. C.

Following is the by-law or ordinance referred to:

By-Law Relating to Garbage and Ashes.

In this part unless the context otherwise requires:

"Dwelling" means any building or place, occupied or used as a dwelling, place of abode, or place of living, but does not mean or include any apartment house, tenement house, or building in which more than two families dwell, abide, or live, or which contains more than two separate places of dwelling, abode or living.

"Householder" means any person occupying or owning any dwelling, but shall not include any person who is merely a boarder, roomer, or lodger in such dwelling.

"Garbage" means any and all rejected, abandoned or discarded waste of household, vegetable or animal food, floor sweepings, tins, and bottles, crockery and glass or metal ware having contained food, and other household refuse matter (except ashes, as hereinafter defined) which can be destroyed or consumed by fire, and metal, tins, bottles, crockery and glass having contained food.

"Ashes" means ashes, cinders and the remains of any fuel after such fuel has been consumed by fire, and metal tins, bottles, crockery and glass not having contained food.

"Wagon" means any vehicle drawn by two horses, having a capacity of at least sixty-eight cubic feet.

"Cart" means any vehicle drawn by one horse and running on two wheels, having a capacity of at least thirty-four cubic feet.

Every householder shall provide and maintain in good sufficient order and repair for each dwelling owned or occupied by him, galvanized iron receptacles (circular in design), each of a capacity of two and one-half cubic feet, and each having a diameter of not more than sixteen inches, and a depth of not more than twenty-four inches, and each provided with a good, sufficient and watertight cover, sufficient, in number to contain all garbage and ashes from such dwelling.

A sufficient number of such receptacles shall, at all times be so kept by such householder, and maintained for garbage and for nothing else, and a sufficient number of such receptacles shall at all times be kept and maintained by such householder for ashes and nothing else.

Such receptacles shall at all times be kept on the premises of or connected with such dwelling and shall at no time be kept or put or encroached upon or project over any street, lane, or public place.

Such receptacles shall, at all times, be kept on a portion of the premises of or connected with such dwelling immediately adjoining a lane, if there be such a lane, and from such lane there shall be provided a gate, door or entrance, of such size and kind as to permit of ready access to such receptacle.

Where there is such a lane, such receptacle shall, at all times, be kept and maintained at such gate, door or entrance, and such gate, door or entrance shall be kept unlocked or unfastened at all times, necessary to allow any employee of the City to obtain access to such receptacles for the purpose of emptying same, and such householder at all times shall permit and allow any such employees to have access to and to empty such receptacles.

Such receptacles shall, in all cases, be at all times kept on the ground level and be so placed as to enable any such employee to empty the same. In case such receptacles are enclosed in any separate shed or housing, then such shed or housing, if there be a lane, shall be built flush with the lane and have doors opening outward upon the lane, whereby the receptacles may be emptied from the lane, and have a lift door inside such premises thru which garbage or ashes may be deposited in such receptacles. In case there is no such lane, and in case such receptacles are enclosed in any separate shed or housing, then such shed or housing shall have doors opening from some side thereof whereby the receptacles may be emptied, and a lift door at the top thru which garbage or ashes may be deposited, and in case there is no such lane, at all times a passage-way and ready means of access to such receptacles shall be provided from the street, and such passage-way and means of access shall be unobstructed and of sufficient size and kind to enable any employee of the City to carry any such receptacle thru same to the street.

Every householder shall deposit all garbage of and from his dwelling in the receptacles hereinbefore required to be provided for same, and shall deposit all ashes of and from his dwelling in the receptacles hereinbefore required to be provided for same.

Notwithstanding anything hereinbefore set out, in the case of dwellings the ashes or garbage of or from which shall amount to more than twenty cubic feet per week, the receptacle or receptacles for such ashes or garbage may be of such other shape, nature, capacity and design, and shall be placed and located in such

places as the City Engineer of the City shall, on application made to him, approve and designate. But otherwise all the provisions of this part shall apply to the case of any such dwelling.

No charge shall be made by the City for taking up, collecting and conveying away any garbage or ashes of any householder from any dwelling as defined by this part, provided that such householder shall have complied with the preceding provisions of this part.

No liquids or free water shall be put or placed in, or allowed to run into, or accumulate in any receptacle for garbage or ashes, and all such receptacles shall at all times be kept securely covered with a water-tight cover.

Except as otherwise in this By-law, or any other By-law of the city provided, every person shall at least once every seven days remove or cause to be removed all garbage and ashes of or from all premises owner or occupied by him, and destroy, or cause to be destroyed, such garbage or ashes either at the city incinerator or outside the limits of the city.

Every person having any scavenging work (other than that for which the charges are hereinbefore specified) or cremating work done by the city shall pay the following fees and charges:

(1) For hauling garbage and ashes:

Per wagon load, one mile or under	$2.50
Per every additional mile or portion of mile	.50
For packing out wagon load	1.00
For cart load, one mile or under	1.25
For every additional mile or portion of mile	.25
For packing out and picking up, per cart load	.50
For packing out and picking up dogs	.50
For packing out and picking up cats	.50

(2) Lessees, owners, or occupiers of any place of business, or buildings other than dwelling houses, desirous of contracting for less than one cart load, shall pay for the removal of garbage and ashes at the rate:

For 3½ cubic feet or less	.12½
For packing out same on the ground floor additional charge for each 3½ cubic feet or less	.02½

(3) Where no contract has been entered into with the city the following prices shall be paid:

For 3½ cubic feet or less	.15
For packing out same, additional charge for each 3½ cubic feet or less	.05

(4) No garbage shall in any case be removed by the Scavenging Department of the city to the incinerator unless the same is placed so that it is free and unmixed with ashes or other non-combustible material, and unless the same is free from liquids.

(5) Prices for Cremating.

Horses, aged and under aged	$3.00
Cows, aged and under aged	3.00
Calves, pigs, sheep and goats	.75
Dogs	1.00
Decayed fruit and vegetables, per 100 lbs.	.25
Condemned fish, per 100 lbs	.20
Fish offal, per 100 lbs	.20
Slaughter house offal, per 100 lbs	.20
Condemned meat, per 100 lbs	.20
Rotten eggs with cases, per 100 lbs	.50
Condemned milk or cream, per 100 lbs.	.30
Refuse (including boxes and crates not exceeding 2 ft. by 2 ft. by 3 ft.), per 100 lbs	.05
Refuse, with boxes exceeding 2 ft. by 2 ft., per 100 lbs	.15
Paper-bound records, per 100 lbs	.10

The Scavenging Department will not accept at incinerator loads containing anything except garbage as defined by this part, or combustible matter.

Any cart, wagon or other vehicle used or intended to be used for the purpose of conveying swill, offal or garbage, shall be and be kept covered, and shall be and be kept perfectly tight and covered so as to prevent the contents thereof from leaking or spilling, and shall be of such pattern and description as may from time to time be approved by the Medical Health Officer, and no such cart, wagon or other vehicle when not in use shall be allowed to stand in any highway, street, lane, alley, public place or square.

All householders and persons shall comply in all respects with the provisions of this part, and any person who fails to comply in any respect with the provisions of this part or any of them, shall be guilty of an infraction of this By-law, and subject to the penalties thereof.

Nothing in this part contained shall relieve any person from complying with the provisions (where they are applicable) of any other part of this By-law, or with the provisions (where they are applicable) of any other By-law of the City.

Form of Report of Work Done in City Street and Sewer Repair and Maintenance

I present you herewith a form of daily report for the assistant street superintendent, which is intended to keep the various work done in this department properly classified as well as to show unit

costs and also serve as a check against the pay roll and expenditures made by this department.

It might prove of interest to other cities of about the size of this city, which has a population of about 12,000.

C. L. CONDER, Corporation Counsel,
Pekin, Ill.

DAILY REPORT

ASSISTANT SUPERINTENDENT OF STREETS

DEPARTMENT OF STREETS AND PUBLIC IMPROVEMENTS

191___

I. PAVED STREETS*

(A) **Name of Street Cleaned**

Where Cleaned

Refuse—Nature of and how disposed

Remarks

(B) **Streets Repaired**

Nature of Repairs

Where

Remarks

(C) **Miscellaneous Street Work**

Where

Nature

Remarks

*If Alleys, so Indicate with an X

PERMITS

For What

Where

To Whom

How Long

INSPECTED AFTER RESTORATION

Where

To Whom Issued

Condition at Time Inspected

GENERAL REMARKS

II. UNPAVED STREETS*

Name of Streets

Where Located

Nature of Work

Remarks

*If Alleys, so Indicate with an X

PERMITS

For What

Where

To Whom

How Long

INSPECTED AFTER RESTORATION

Where

To Whom Issued

Condition at Time Inspected

	Number Men Employed	No. Teams	No. Sq. Yds. Done	No. Loads Refuse	No. Cubic Yards	Length of Haul	No. Hours Worked	No. Hours Teams	Labor Cost	Team Cost	Miscellaneous Cost	TOTAL COST	
(Paved Streets) A													
B													
C													
(Unpaved Streets) II													

III. CURBING

(A) Where Placed (New)

Kind, State whether done by Contract or Day Labor

Size

(B) Name of Streets Curbing Repaired

How Repaired

Remarks

	Contract Price per Linear Ft.	Quantity Laid	Specifications	Cubic Ft. Sand	Cement	Cubic Ft. Gravel or Stone	Cost Sand	Cost Cement	Cost Gravel or Stone	Team Cost	Labor Cost	TOTAL COST	
A													
B													

IV. CROSSWALKS

(A) Where Placed

Kind, State whether done by Contract or Day Labor

Size

(B) Name of Streets Cross Walks Repaired

How Repaired

	Contract Price per Linear Ft.	Quantity Laid	Specifications	Cubic Ft. Sand	Cement	Cubic Ft. Gravel or Stone	Cost Sand	Cost Cement	Cost Gravel or Stone	Team Cost	Labor Cost	TOTAL COST	
A													
B													

V. SIDEWALKS

(A) Where Placed

Kind, State whether done by Contract or Day Labor

Size

(B) Name of Streets Sidewalks Repaired

How Repaired

Remarks

	Contract Price per Square Ft.	Quantity Laid	Specifications	Cubic Ft. Sand	Cement	Cubic Ft. Gravel or Stone	Cost Sand	Cost Cement	Cost Gravel or Stone	Team Cost	Labor Cost	TOTAL COST	
A													
B													

VI. SEWERS

(A) Where Cleaned

How Cleaned

(B) Repaired, How and Where

(C) New Sewers Built, Where, Kind

Remarks

	No. Catch Basins Cleaned	Number Men Employed	Number Teams	Loads Silt Removed	Cu. Yds. Silt Removed	Amount Work Done	Sewer Tile Used	Labor Cost	Team Cost	Material Cost	Miscellaneous Cost	TOTAL COST	
A													
B													
C													

VII. CITY TEAMS

Number Horses	Number* Wagons	Tons Hay	Tons Straw	Bushels Oats	Bushels Corn	Number Teamsters	Cost Hay	Cost Straw	Cost Oats	Cost Corn	Labor Cost	Cost Shoeing	Repair Cost	TOTAL COST	

*If Other Implements Used, Indicate.

Grand Total, $ .....

Signed .....

Assistant Supt. of Streets

July, 1914

Who Supplies Novaculite?

To the Editor MUNICIPAL ENGINEERING:

Sir—I note the inquiry in the June number of MUNICIPAL ENGINEERING and this is to advise that the Novaculite Paving Company has its office in the Victoria Building, Eighth and Locust Sts., St. Louis, Missouri. Its quarry is at Tamms, this county.

This city has used much of this product in the past and will shortly advertise for Paving District No. 1, and all the paving in said District will be Novaculite.

ROBT. A. HATCHER,
City Clerk, Cairo, Ill.

Voids in Crushed Stone

C. A. Baughman, of the Iowa State College Engineering Experiment Station, Ames, Iowa, refers W., whose question is printed on p. 544 of the June number of MUNICIPAL ENGINEERING, to Bulletin 23 of the Engineering Experiment Station of the University of Illinois, Urbana, Ill., for information concerning the voids in crushed stone.

Bulletin 23, by Ira O. Baker, was published in 1908, and gives details of methods and results of tests on Joliet, Chester and Kankakee, all Illinois limestones, considering specific gravity, absorptive power, and percentage of voids Voids were determined from specific gravity and by pouring in water, on various sizes of stone placed in various sizes of vessels, with various heights of drop into the vessels. Settlement of crushed stone in transit in cars and in wagons, and the weight per cubic yard were also studied thoroughly, as well as the relations between weights of crushed and solid stone. An appendix gives some results for weight and voids of crushed trap rock.

Following are some of the average results:

Size of Stone.	Percentage of Voids.
⅜-in. screenings	39.6 to 46.8
½-in. screenings	42.2 to 47.1
¾-in. screenings	43.0 to 45.6
1¼-in. to ⅜-in. screenings	42.2 to 45.7
2 -in. to ½-in. screenings	46.2 to 47.9
2 -in. to ¾-in. screenings	46.6
2¼-in. to ⅜-in. screenings	42.9 to 44.3
2¼-in to1¼-in. screenings	43.4 to 46.2
3 -in. to 2 -in. screenings	45.1 to 47.5

There are opportunities for variation in results, because of use of two methods of determining voids, three kinds of stone, six sizes of vessels used in the experiments, five different drops of stone into vessel, from shoveling in to 20 feet drop, different observers, etc. The individual results give somewhat greater ranges than the averages quoted.

With each size of vessel used the voids increase with the size of the stone. Voids are materially less with 20-foot drop into vessel than when simply shoveled in. For large stone the difference between the methods of determining voids is practically nothing, but with smaller sizes the method by pouring in water gives considerably smaller percentage of voids than computation from specific gravity.

Conscience in Municipal Engineering

To the Editor MUNICIPAL ENGINEERING:

Sir—Conscience may be defined as an inherited tendency towards righteousness. It may remain dormant, but, fortunately, the majority of the individuals who constitute the "mass of humanity," possess this potential righteousness, and its awakening at some period during the career of the individual is probable.

The awakening of conscience is betokened by the assumption, the introduction and the subsequent practice, with more or less consistency, of a code of morals. This code is, however, practiced in two distinct manners. The majority are content to practice it conservatively and at home, avoiding carefully all temptation to violate it and succeeding admirably in adhering to well formulated principles without in the least disturbing the equanimity of their less moral neighbors and without, in any way, entering into the general conflict against the common evils which confront the race. Those of the other class, still in the minority, unfortunately, practice their codes openly, aggressively and with initiative. These are the leaders in the movements toward betterment in all walks of life and the achievements of a number of them whose activities are directed towards the public welfare, in what is commonly known as civic betterment, are of vast importance to the progress of civilization.

Coming to the point, we may take New York as the scene of the strife for civic betterment and may consider the municipal engineer in his attitude towards it. One does not have to delve into remote history to reveal this person in the guise of a moral tadpole. It is within the memory of living man, when he wiggled about in the pool of civic stagnation, hoping for the day when, as an active moral frog, he might jump to the bank and view the sunlight. The day has arrived and while the sunlight may, perhaps, at times, be obscured by a passing cloud, it is true that the tadpoles are developing hourly and are emerging in new form from the depths of the dark pool. Having seen the sunlight, it is the impulse of those whose lot

has been cast in the pool, to go back and clarify it.

We are thus daily increasing the numbers of those who are aggressively following their code of morals. We are passing the time in which we were content to tolerate on the part of others what we considered improper for ourselves. We are unwilling to yield to those who will not see the sunlight and we are going to bring them into it or destroy them.

The latter day practice in municipal engineering has developed with some and has been forced upon others on the theory that each man must show his hand, he must work in the open, and the barrier of mystery in which the incompetent surrounded himself to conceal his incompetence, and with which the competent surrounded himself for protection against the incompetent, is destroyed. The "one-man policy" in which the person in a position of advantage acquires and holds information essential to the proper conduct of a piece of work, thereby making himself indispensable, is becoming obsolete. Engineers find that their positions are more secure and more important when they are understood than when their work is shrouded in mystery. It is no longer expedient to cover one's tracks in order to conceal possible errors. It is far more profitable to acknowledge and correct them. The executive engineer who exposes and reports his own mistakes as well as those of his subordinates gains the confidence of his superior officers and the respect of his subordinates. If his mistakes are too numerous to be tolerated, the old style concealment will not avail, for, as it has been said, the new idea is being forced upon those who do not adopt it voluntarily.

It frequently happens that specifications are incomplete, that some item of importance is omitted, or that some unexpected obstacle is encountered in the execution of the work which the contractor refuses to correct or overcome, without extra compensation. It has been known that such difficulties have been adjusted by an arrangement between the engineer and contractor, whereby the latter would be released from some less important obligation in compensation for his performance of the additional work. While these bargains were almost invariably made on the "dollar for dollar" basis and were usually of benefit to the work, it is within the scope of imagination to conceive of cases in which the exchange was not equitable and in which the bargain was made rather to conceal errors than to correct them. When, however, the work must be publicly reported in detail, or when the work is executed by an engineer who is beyond the control of the one who drew the specifications, the latter is required for his own protection to develop more carefully the details of his work so that corrections in the field will not be neecssary.

Another abuse which has been abated by publicity is the ancient system of continuing work until the appropriation, far too large originally, became exhausted. It has happened that work has been extended and modified repeatedly until the ultimate creation was far in advance of the original and the funds still showed a balance. The process was similar to the plan pursued by the suburban homesteader who purchases a gallon of paint to cover the kitchen porch and finding a large balance on hand after having completed it, proceeds to paint the back fence and the barn doors. With specific appropriations based upon itemized estimates, carefully analyzed, there is no balance remaining after the completion of the work, and therefore its indefinite extension is not possible. Again the preparation of the specification and the estimate must be more careful for "extras" cannot be met within the appropriation.

There is another phase of municipal work which has undergone a change in recent years, and that is the relation between the executive engineer and his subordinate. The former is rapidly realizing that the errors of the latter will be revealed in the day to day "exposures." It is unprofitable to protect an incompetent subordinate for political or personal reasons, because the incompetence of the subordinate will be accredited to the superior who attempts to conceal or correct poor work.

Ability is a comparative term and it fails to express all the qualifications which the latter day engineer must possess. Yesterday a man was judged alone on his ability and promptness. Today he must be capable, prompt and efficient. We have a new dimension to consider, the unit of which is the American dollar. In order to measure up to the new standard, a man must possess all three dimensions, the product of which is competence. The new idea then of competence includes ability, which is largely built on experience, it includes promptness which means energy, and it includes efficiency which means study. To be efficient one must recognize the errors made by himself and others and studiously avoid both. Someone has said that efficiency is common sense; it is more than common sense, it is insight.

The improved definition of competence, as set forth above, is today the test which every engineer must meet. He may possess one of the elements in larger measure than the other two, but he must possess some amount of all three and the executive engineer must possess even more than this newer competence; he must possess conscience, the active ag-

gressive kind of conscience which influences other men. He must be one of the frogs already on the bank, one of the fellows who have seen the sunlight.

Again, he must possess courage, for conscience without courage is not a valuable asset. He must possess courage which will prompt him to go back into the pool and clean it. Taking then this alliterative trio, competence, conscience and courage as basic ingredients, we may mold a man of worth as an engineering executive.

The optimist believes that such men are already with us, men possessing the basic principles of leadership, and he believes there are a few who also occasionally reveal higher human attributes even than these, such as sympathy, fellowship and kindness, all of which are defined as consideration and all of which result, or at any rate develop from association with wholesome and cultured beings. As time advances, there will be more engineers, civic and private, who possess competence, conscience, courage and consideration.

ALFRED WILLIAMSON, Mechanical Engineer, Department of Water Supply, Gas and Electricity, New York City.

Boston Well Supplied With Rapid Transit Facilities

In the opinion of the Boston Transit Commission, of which George F. Swain is chairman, the business section of Boston covers a comparatively small area, and within this area there is apparently already provided a greater mileage of subway and elevated lines than in any equal area in any American or foreign city, with the possible exception of London and New York. The area of the peninsula of Boston, bounded by the Charles river, the harbor, Fort Point channel, Dover and Berkeley streets, is only about 1.80 square miles. Within this area there are already in operation, or under construction, about 9.05 miles of subway and elevated lines, with about 19.7 miles of single track. If the area were square, this mileage would provide for double track rapid transit lines crossing it in each direction at intervals only about 1,800 feet apart. Taking the actual shape of the area, there is no part of the business district east of Beacon Hill, which is more than about 1,100 feet distant from some rapid transit line. The distance from the Washington Street Tunnel, a thru line north and south, to Atlantic avenue at the head of docks along the harbor on the east is about 2,000 feet. There are three north and south rapid transit lines thru this district, namely: the Tremont Street Subway, the Washington Street Tunnel and the Atlantic Avenue elevated line, and the distance between adjacent lines is nowhere more than about 2,200 feet; and there are two rapid transit lines east and west through the district, namely, the East Boston Tunnel and the Dorchester Tunnel and these are nowhere more than about 2,800 feet apart.

It is thus evident that the business section of Boston is already well provided with underground and overhead rapid transit lines; and by transfer it is possible to reach any point on any one of these lines, going in the same general direction, for a single fare.

These figures will perhaps illustrate the character of the facilities which have already been provided, and will show the need of exercising great caution before advising the construction of another underground line in this limited district at the present time.

Burned Asphalt Cement Can Be Prevented

Few contractors realize the seriousness of burned asphalt cement and the amount of money lost through this cause. Pavements crumble away and yet hardly any attention is paid to this particular cause of their crumbling. Hardly any contractor would risk using hydraulic cement in his concrete that he knew had been spoiled, because common sense would tell him that he might have to take all the concrete up again, and yet he seldom stops to think that his asphalt cement may have been burned and therefore spoiled, and that he may have to take up his course of top and binder as a consequence. Experience has proved that when steam at a pressure of 125 pounds and without superheat is used in coils placed across the kettles, the asphalt cannot exceed 350° F. and in kettles properly constructed for the purpose, the heating of a large mass of asphalt takes much less time by this means than with furnace heat applied to the exterior of the kettle at a temperature of at least 1200° F. Also, no burning takes place; whereas, in the case of furnace heat at 1200° F. all asphalt coming in contact with the part of the kettle nearest the furnace is burned in spite of any agitation given it. Where furnace heat is used, the vital operation of heating the asphalt cement generally depends upon the intelligence of a $3.50 per night colored man. He, as a rule, is no more conscientious than an average hired laborer, and as the superintendent cannot work 24 hours every day and watch the night work as well, takes frequent advantage by sleeping during the night and then firing very heavily towards morning to have the A. C. hot enough for the morning. This cannot occur with steam heat. It has also been proved that steam heat

is more easily regulated and the resultant penetrations have been more regular as a consequence.

Asphalt manufacturers are adopting steam heat more and more every day as they realize the danger of furnace heated kettles spoiling their products.

Buckling of New Brick Pavement at Elmira, N. Y.

To the Editor MUNICIPAL ENGINEERING:

Sir—A valuable lesson in brick paving construction was afforded at Elmira, N. Y., on June 10 when a section of a new brick pavement buckled, due to the intense heat of the sun.

Regardless of the sun's heat or any other weather condition, this pavement, in the opinion of experienced pavement engineers, would not have buckled had it been equipped with transverse expansion joints.

The pavement on which this buckle occurred was built late last fall. It extends a distance of 1940 feet on West Church street, from Hoffman street west of Guinnip avenue, and is one of a series of connecting links to the New York State highways now under construction in the southern section of the state.

The firm of Holleran Brothers, Elmira contractors, built the pavement under the direct supervision of the state highway department. The specifications were followed out to the letter and the pavement was declared one of the best built in this section of the state.

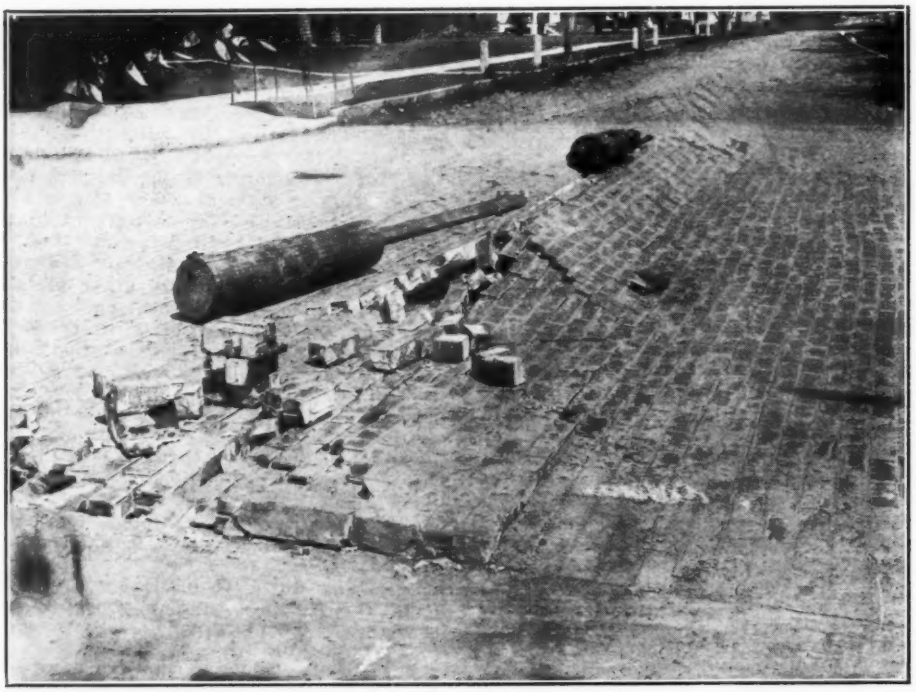
The State Highway Department, however, did not deem it necessary to include transverse expansion joints in the specifications for this pavement and, of course, they were not put in.

On the afternoon of June 10 there was a loud report, which came from underneath the bricks at the corner of Foster avenue and Church street. Almost simultaneously the pavement heaved and buckled in a mound nearly the entire width of the street as the accompanying illustrations show.

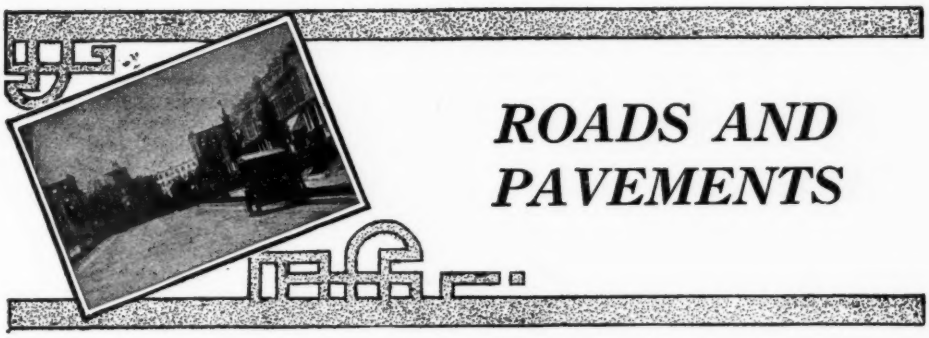
City Engineer Brown and Resident State Engineer Child, after an inspection of the buckle, found that the foundation had not been injured in the least. The heat of the sun had caused the bricks to expand and buckle. They declared the accident would not have occurred had transverse expansion joints been put in when the pavement was built.

As a result steps have been taken to place expansion joints in other state pavements now under construction in this city and vicinity.

JOHN T. CALKINS.



BUCKLING *of new brick pavement in Elmira, on Church street, at intersection with Foster avenue.*



ROADS AND PAVEMENTS

Empirical Requirements in Asphalt Specifications

By Leroy M. Law, Chemist of the United States Asphalt Refining Company, Baltimore, Md.

In many of the early types of specifications we have seen such requirements as "The material must be A. B. C. brand or equal thereto" and "The material shall have given satisfactory service under similar conditions for such a period of time." Such conditions especially unfair to the manufacturer are rapidly disappearing, yet today in many of the so-called scientific specifications, the adoption of requirements based on arbitrary methods of analysis has placed the honest producer in an equally uncertain and embarrassing position. It is to three such such requirements which have gained and still hold surprising popularity in many current bituminous specifications that I now invite your attention.

The first stipulation of this character to be mentioned is that limiting the so-called "fixed carbon," and it is indeed difficult to understand just how this requirement ever secured a foothold in asphalt specifications.

Fixed carbon is a test stolen from fuel chemistry, where it serves to indicate the coke remaining after the gaseous constituents have been removed by heating the material, with exclusion of air, under prescribed conditions. Those who have had any experience in fuel work whatever know full well that this test is purely empirical and that the variations among different operators, especially in different laboratories, is often considerable, and that this method is not applicable even to some fuels. How much more inapplicable then will the method be to softer materials like the asphalts and road oils, which have also the disagreeable tendency of foaming out of the crucible at certain stages of the heating?

Difference in gas used in heating and in polishing of crucible introduce errors.

If the wide variations shown in tests occur with coals what, then, should we expect when the method is applied to soft asphalts and even oils?

As a chemist of one of the large asphalt companies, I have observed this fixed carbon requirement enforced to extremes and yet to no purpose or benefit to the consumer. The yield of fixed carbon can not be controlled in the process of manufacture, unless thru gross carelessness in coking material. In this case, the defects will be shown far more accurately by increased insoluble matter in the various reagents employed in bitumen analysis.

Some weeks ago the writer prepared two samples of bituminous material of different consistencies, dividing each sample into several portions. These were sent to several laboratories to make the fixed carbon tests. The operators selected were not those of the usual commercial laboratories, but chemists who are especially qualified and equipped for asphalt work, and regarded as our foremost experts in this branch of the profession. The tabulated results of their work are shown in the accompanying table.

Results of Fixed Carbon (Percentages).

Sample No.	213	215
Laboratory A	12.00	17.4
Laboratory B	13.62	16.85
Laboratory C	10.91	13.13
Laboratory D	12.52	17.54
Laboratory E	12.63	17.20
Laboratory F	17.10	22.00

Inspection of the figures shows a variation in fixed carbon on the same samples of over 6 per cent. in one case and nearly 9 per cent. in the other. When experienced operators such as the above differ by these amounts on identical samples, is there any wonder that with chemists generally the variations are even greater? It is to be regretted that chemists do not study the value of these tests before incorporating them in their specifications and extend to good materials and their honest manufacturers a just consideration.

Some days back it was our misfortune to have a shipment of asphalt rejected, because the fixed carbon as determined

in the customer's laboratory ran from one-tenth to three-tenths in excess of the prescribed limit. I had previously tested the batch from which this shipment was made, and found the fixed carbon considerably below the requirements of the specifications. An absurd feature of the case is that another carload from the same batch was accepted as meeting the requirements, the inspecting chemist, doubtless, being unconscious of the variation he was experiencing in his own laboratory.

But I leave the subject of fixed carbon to pass to another empirical requirement of still greater uncertainty; i. e., the so-called paraffin determination.

This procedure is supposed to show the amount of hard or "scale" paraffin present in the material and is, therefore, considered to be an index as to its liability to crack in cold weather or granulate with age. The general procedure employed in this determination is doubtless familiar, consisting of distilling the material rapidly down to dry coke and collecting the distillate. The latter is then weighed, an aliquot portion removed, dissolved in alcohol-ether, chilled and the crystallized scale filtered off, dried and weighed. Many specifications prescribe that the scale shall not exceed a certain figure, yet few of them prescribe their modifications in detail. The results are that each customer performs the test in the manner most agreeable or convenient to himself, and the manufacturer has to stand for the whims and modifications introduced.

In an effort to learn something as to the paraffin test as generally applied, the six laboratories who replied to the fixed carbon inquiry were also asked to determine paraffin scale in the same samples. They did so with the exception of one laboratory, which, for reasons not stated, declined to make the determinations. I trust that laboratory E realizes the unscientific status of the paraffin scale test and it was this realization that prompted them to decline to report on the subject.

Results on Paraffin Scale (Percentage).

Sample No.	213	215
Laboratory A	3.6	2.8
Laboratory B	0.10*	1.58
Laboratory C	2.7	1.49
Laboratory D	1.21	1.25
Laboratory E	....	....
Laboratory F	4.13	3.04

*Material foamed considerably. Analyst is of opinion that there is no accurate method and results are only approximate.

The above results tend to make a laughing stock of the profession and are printed only with the hope that asphalt chemists may soon get together and study or eliminate these embarrassing subjects.

Our company is furnishing a certain material to one customer who limits paraffin to 1 per cent. From him we have had no complaint whatever, yet the same material is ineligible under another specification, having been reported to contain paraffin in excess of 4 per cent. I ask you candidly which chemist is right, and what is the manufacturer to do under such conflicting evidence?

Turning now to a third requirement of questionable scientific value, and non-indicative of either quality or service results, I call attention to a requirement in many road oils and binder specifications which states that the material at, say, 50 penetration, shall have a specified minimum ductility. The idea is that the bitumen shall possess adhesiveness, a quality best shown by the ductility test and by concentrating to 50 penetration, the standard consistency for this ductility test, all materials are brought to a uniform basis of comparison.

Thus far, the idea is sound but the method of concentration, the all-important feature, is sadly and ignorantly neglected. Some chemists in a blind attempt at conserving ductility, stipulate that during concentration, the temperature shall not exceed, say 400 or 500 degrees F. Others provide for "occasional" stirring, but generally they neglect the essential feature in asphalt treatment, namely, the agitation. In hardening the softer asphalts, agitation plays, if anything, a far more important role toward conserving ductility than does the mere restriction of temperatures. My interviews with inspecting chemists relative to this test, show that they are uniform only in following "no regular procedure."

Some of them use heat test residues which by accident have just reached 50 penetration, or again this residue treated to a further heating on a hot plate or in an oven to obtain the desired consistency. Others concentrate the material from an oily state to asphaltic consistency in a single operation, either on a hot plate or in an oven, with or without agitation, as suits their fancy, and the manufacturer must ascertain and duplicate in his laboratory all of these eccentricities to find out the chance his material has of passing a so-called scientific specification.

On one occasion the writer submitted to a prospective customer a series of asphalt products and asphalt cement. These were tested by the inspecting chemist who passed the harder materials, but rejected the softer ones, as absolutely lacking in ductility when reduced to 50 penetration.

The chemist allowed me to look over his results, and I observed that with the material requiring the least concentrations he had secured the highest ductility and in case of the fluid material, requir-

ing the greatest concentration to reduce it to 50 penetration, practically no ductility was obtained. All of the products were from the same primary material, the maltha, the harder ones being produced by refinery operations which neither he nor anyone else could duplicate in the evaporation tins of the asphalt laboratory.

In the instance cited, the chemist's process was undoubtedly one destructive to ductility, for the longer the heating required to reach 50 penetration the lower the ductility of the product. The individual in question avoided the issue by deciding that to his mind the test represented service conditions where no agitation of the material took place.

Such clauses as fixed carbon, paraffin scale, etc., in their present empirical state and coupled with a narrow and rigid interpretation are not only a discredit to the profession, but destroy the value of a sincere specification.

It has just been stated that the principal object of the specification is to lay before the manufacturer in a clear, concise manner the requirements that are to be met. When he is unable to interpret these with a reasonable and standard equipment, the purpose of the specification fails.

The rapid development in bituminous highway work during recent years has been accompanied by an accumulation of inspection methods, desirable and questionable ones springing up together, and the many young chemists in this field of work doubtless look upon them as methods of established, scientific value. Other chemists with only time for routine work of testing become advocates of such requirements as they might otherwise suppress. Furthermore specifications of one city or municipality are frequently copied from those of another, which presumably from a longer experience in bituminous work is looked upon as a criterion in such matters.

And so by these and other unstudied procedures our asphalt specifications have been brought to this present empirical condition, and the time is at hand for chemists in this branch of the science to co-operate in weeding out the tangled field of laboratory methods.

No one chemist should, and no true scientist will, decide that check results in his own laboratory establish the reliability of a test or method of analysis. Such is at least to be expected. A true scientist will endeavor to ascertain what the procedure shows in the hands of others, presuming, of course, average qualifications in experience and skill.

If as a result of such study fixed carbon, paraffin, etc., are found to be of value, then it will be of interest to all concerned to adopt definite procedures and agree on the limitations of accuracy. If they cannot be developed into real scientific methods, capable of yielding concordant results in the hands of all qualified chemists, then they should, by mutual consent, be abandoned. In their present empirical condition they can not be of any possible assistance in determining the quality or even the uniformity of a product, but on the other hand, their employment frequently works injustice to valuable materials.

Variations from the Standard Asphalt Specifications

The points in Mr. Law's article above are emphasized by some recent specifications. Two of these are selected for consideration here because they are so nearly opposite in the results obtained in the selection of asphalts for use.

One of these is the specification adopted by City Engineer George C. Powell, of Toronto, Ont., for the purchase of asphalt for the municipal asphalt plant. Following are some of the provisions of these specifications:

All asphalt herein shall be obtained by heating crude natural asphalt or crude asphaltic petroleum without the admixture of any other material to a temperature of 400 degrees F. until all the water and light oils have been driven off, and the refined asphalt thus obtained must meet the following requirements, viz.:

(1) It shall contain not less than 90 per cent. of bitumen.

(2) Not less than 98.5 per cent. of its bitumen shall be soluble in carbon tetrachloride at air temperature.

(3) Not less than 65 per cent. of its bitumen shall be soluble in standard petroleum naphtha at air temperature, and the word "bitumen," as used in these specifications, shall signify and shall be taken to mean "any hydrocarbon, or hydrocarbons, soluble in carbon bisulphide at air temperature.

(4) It shall not contain more than 15 per cent. of fixed carbon on ignition.

(5) Fifty grams of refined asphalt, when heated in an open flat-bottom cylindrical dish, 2⅞ inches in diameter and 1¼ inches high, shall not lose more than 5 per cent. of matter by volatilization at 325 degrees F. in twenty-four hours.

(6) It shall not be softer than sixty penetration at 77 degrees F. (Dow machine).

(7) It shall not be harder than that which will require more than 15 per cent. of flux, calculated on the percentage of bitumen, to produce an asphaltic cement of forty-five penetration at 77 degrees F.

(8) The flux used in the preparation of the asphaltic cement above mentioned will be any suitable standard flux having

a specific gravity at 60 degrees F. between 0.9395 and 0.9722.

(9) All asphalt herein shall be subject to the approval of the commissioner of works and be tested at destination.

One expert states that with the exception of the fixed carbon test these specifications will admit practically every asphalt with the exception of Trinidad or Cuban or other materials which do not contain more than 90 per cent. bitumen.

The controversy at Toronto has been based upon the fixed carbon requirements of not more than 15 per cent. This makes it very difficult for the Mexican people to supply their material, as they are very apt to run higher than 15 per cent.

Another expert arrives at almost exactly the same conclusions.

The city engineer of Indianapolis, Ind., B. J. T. Jeup, has recently let contracts under a new specification, the first paragraphs of which read as follows:

The refined asphalts for sheet asphalt pavements shall be either Trinidad Lake, Cubanel, Texaco, Bermudez Lake, Mexican or California. These asphalts are divided into three grades and contractors shall submit bids stating grade or grades of asphalt bid upon.

First Grade—Trinidad Lake refined asphalt.

Second Grade—Cubanel and Texaco refined asphalts.

Third Grade—Bermudez Lake, Mexican and California refined asphalts.

The asphalts and asphaltic cement shall conform to the following specifications.

Then follow special specifications for each of the asphalts above named and for the asphaltic cements made from each and the fluxing material.

The city had previously purchased asphalt for the municipal repair plant on a more general specification, securing asphalt of what is above termed first grade.

Both the Association for Standardizing Paving Specifications and the American Society of Municipal Improvements, with which the former association is now amalgamated, have adopted standard specifications which are better than the Toronto specifications, in that they admit good asphalts which the Toronto specifications exclude, and exclude poor asphalts, some of which, according to the experts, can get in under the Toronto specifications.

Possibly they are better than the Indianapolis specifications. At any rate, they do not name brands and the principle on which they are constructed is to specify the resulting paving material, rather than to name the acceptable asphalts and present separate specifications for each one named, thus putting the choice of asphalts to be admitted and to be rejected upon the department of public works rather than upon the expert in asphalt paving, leaving to the latter only the question as to whether the specifications have been followed, which is merely a matter of inspection, and giving him no duty in the line of determining whether the resulting pavement is a good one or not; the assumption being, of course, that the asphalts named, if laid in pavements according to the respective specifications provided, will produce good pavements. The division into classes seems to indicate that the pavements are not expected to be equally good, tho it will not be easy to distinguish the resulting pavements, methods of handling having more influence than qualities of the materials named in determining their quality.

The standard specifications of the A. S. M. I. apparently fill Mr. Law's expressed need for a standard, and they do not have the defects of which he complans. Possibly he may not agree with all of their requirements, but, at any rate, they would produce uniformity if they were followed, which is one of his desires. They are open to modification each year, but the conservatism of the body prevents the change of the specifications in any details without full and careful technical discussion, so that a proposed change must have proved its value before it is admitted.

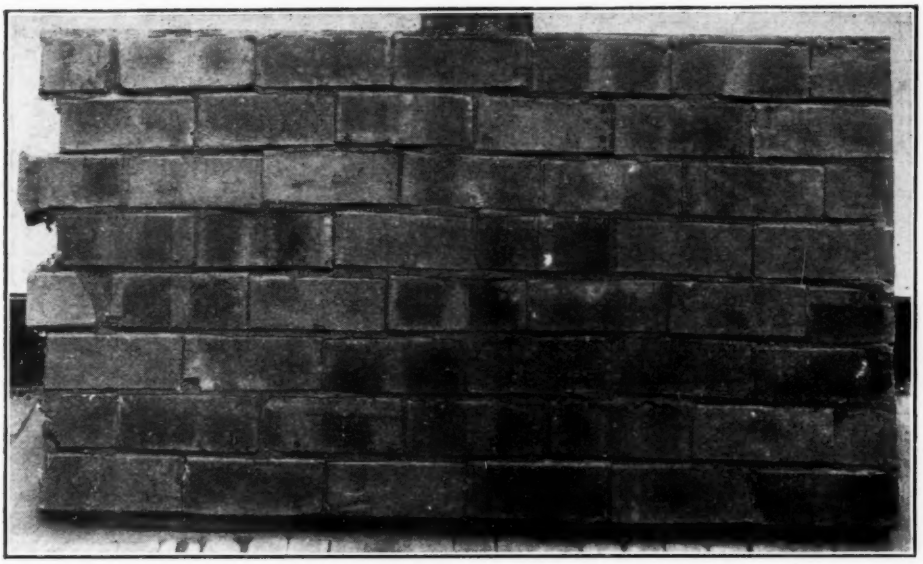
Slab Tests of Brick Pavements

For some years the State of New York has used wire-cut-lug brick for paving highways and many miles of pavement have been laid with the wire-cut-lug bricks with grooved ends to insure complete filling of joints with the cement grout filler.

A few months ago the wire-cut-lug brick was improved by the substitution of a double bevel on the ends instead of the end groove, the bevel being about 1/16 inch from the vertical, the adjoining bricks theoretically touching on a line at the center with at least a ⅛-inch opening at the top and bottom. This allows for the proper penetration of the grouting material at the ends of the brick. This improved form of the wire-cut-lug brick was fully described in the April number of MUNICIPAL ENGINEERING.

When these improved bricks were first shipped to a New York State Highway job the State Highway Department was doubtful of the beveled ends. A thoro competitive test of the new form of wire-cut-lug brick with repressed brick was ordered by Mr. Ricker, the first deputy state highway commissioner, and division Engineer Wm. E. Acheson made the test and report.

Two of the accompanying photographs, which accompanied Mr. Acheson's report, show the bottoms of brick slabs made by laying and grouting the brick in the same

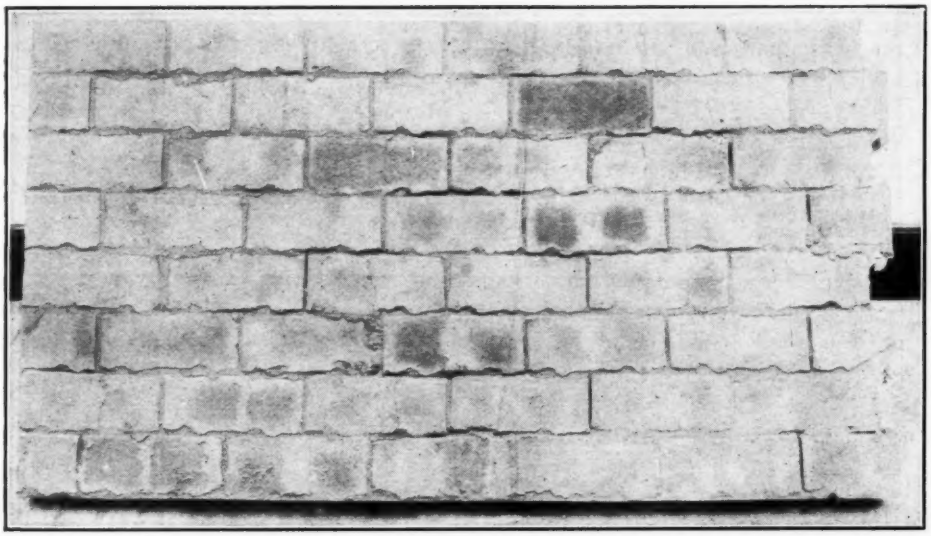


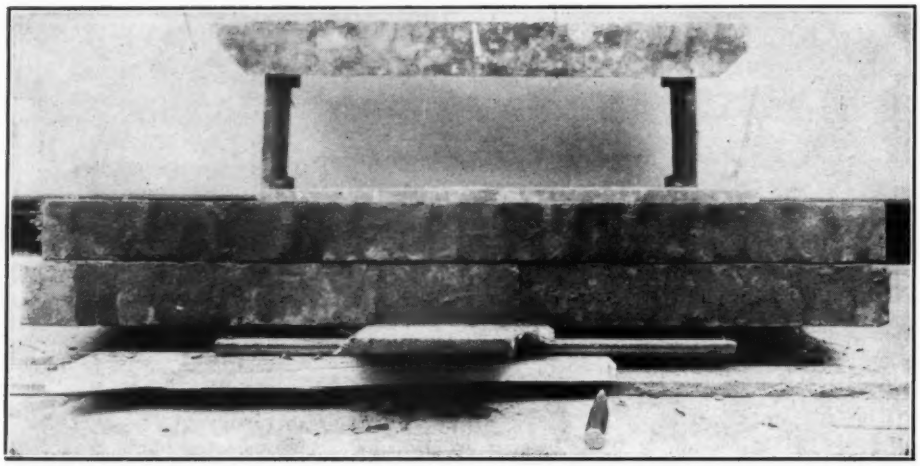
BOTTOMS *of slabs of brick pavement showing complete filling of joints with cement grout. Repressed brick slab above; slab of wire-cut-lug brick, with beveled ends, at bottom of page.*

way that they are laid in pavements, one showing the wire-cut-lug brick slab and the other the repressed brick slab. The thoro filling of the joints in both cases is clearly shown.

The slabs were then split to see how uniform the penetration had been. To split the repressed brick slab but one blow of the chisel and hammer was necessary, while blows from chisel and hammer at five different points were necessary to separate the wire-cut-lug brick slab, and the bonding cement-filler, instead of cleaving free from the brick, broke, leaving grout adhering to the faces of the brick on each side of the joint. The superior bond with the wire-cut-lug brick is attributed by Mr. Acheson to the rough surfaces of the wire-cut brick as compared with the smoother surfaces of the repressed brick.

Two of the photographs show the surfaces of the joint so split, one part of the slab being laid on top of the other





SLAB OF PAVEMENT *of wire-cut-lug brick, showing both sides of joint on which slab was split. Note grout attached to brick, the grout breaking rather than pulling off the brick. No break on end joints.*

so as to show both surfaces of the joint that had been split.

Mr. Acheson also showed that the double-beveled ends give a superior joint, for the repressed brick section could not be lifted from the floor without weakening at the end joints. The arrow in the photograph of the repressed brick joint points to one joint which broke in lifting the slab at one end. Under like test the wire-cut-lug slab remained intact, the end joints showing no tendency to yield, even tho the slab was turned end for end.

Mr. Ricker made a personal inspection of the tested slabs and admitted the bev-

SLAB OF PAVEMENT *of repressed brick. Note clean brick surfaces. Slab broke at joint shown by arrow when lifted at one end.*

eled end wire-cut-lug bricks for use and a separate order will be issued for each contract for which they are accepted until the state specifications can be changed so as to include them specifically.

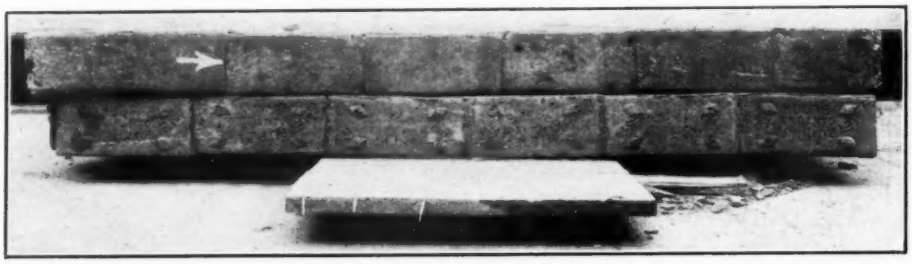
Bituminous Concrete in the Roland Park-Guilford District

By J. C. Little, Chief Engineer, Baltimore, Maryland.

This suburban development is located just north of the central portion of Baltimore City, partly within the city and partly in Baltimore County, composed of about one thousand acres of restricted land, and is considered one of the most beautiful suburban developments in this country, and, naturally, great stress is laid on the looks and durability of the roads.

On account of the high, rolling lands, some very interesting engineering problems arise in working out the curvilinear alinements, grades and intersections of the various roads, which are decided contrasts with the usual rectangular layout of cities, as can be seen by cut No. 1.

During the twenty years' experience of the Roland Park Company several types of



road construction have been used, but the bituminous concrete road bids fair to be the most satisfactory, and has been adopted as the standard form of construction.

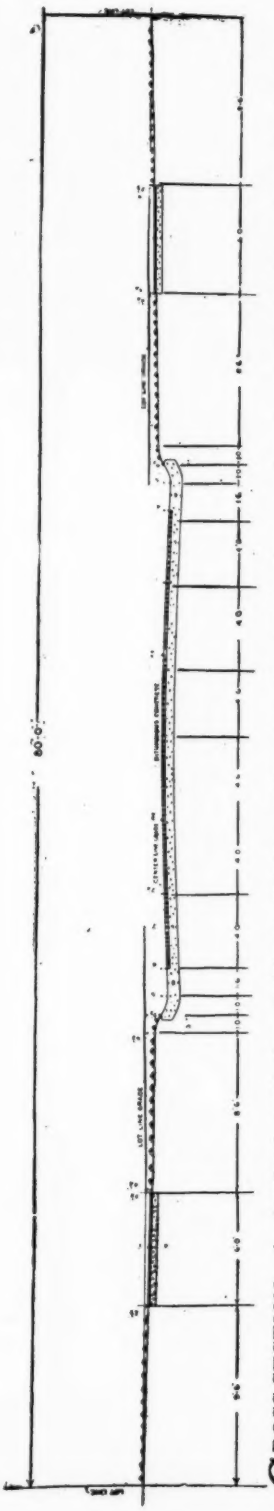
The cross-section varies according to the width of the roads, and has a very pleasing appearance, due to the uniform color from rebut to rebut and the absence of a curb. A typical section is shown in cut No. 2.

The roads are all constructed by the company and not by contract. The method of procedure can best be described by the short specifications which I have prepared for the use of the field men, which are as follows:

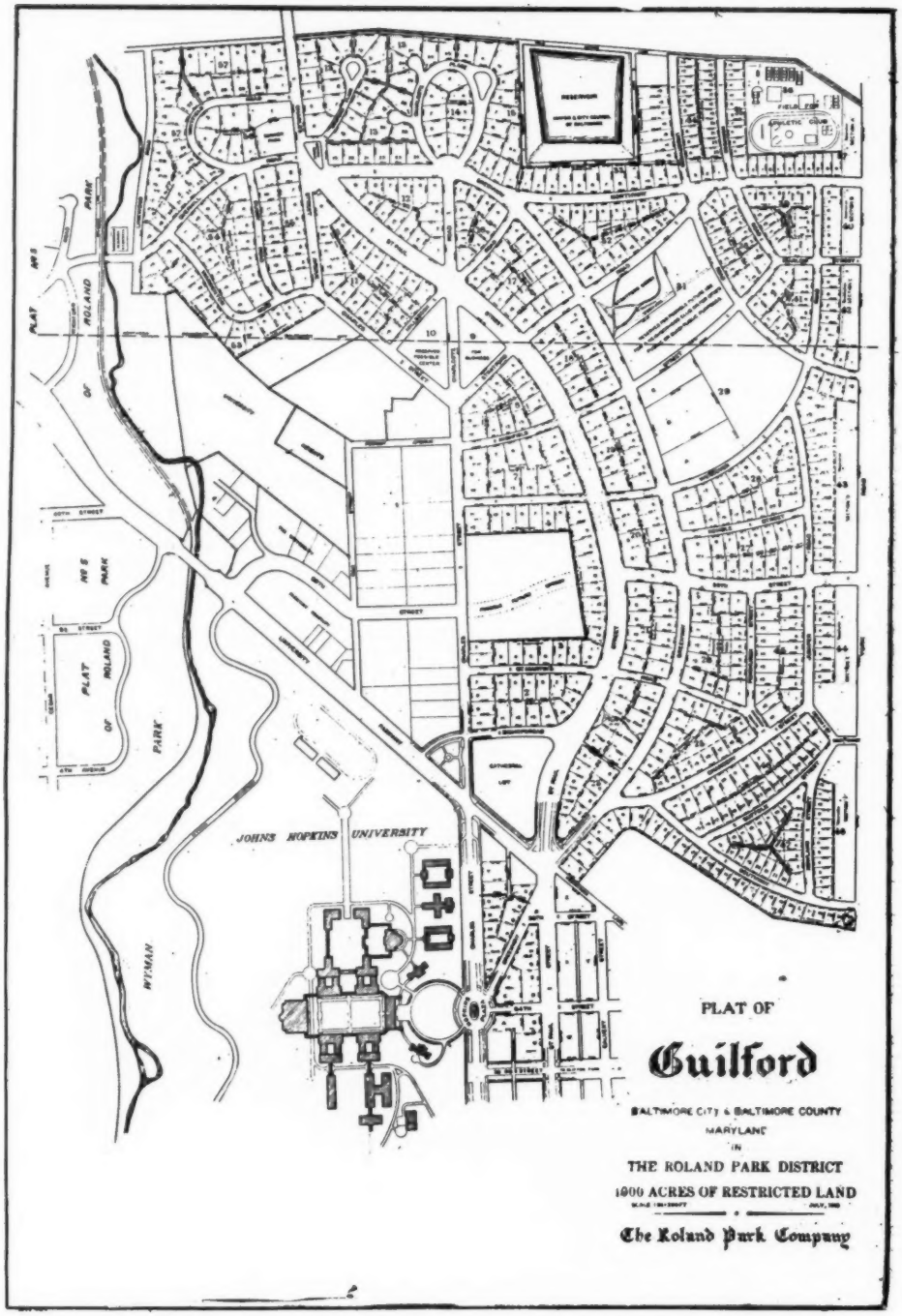
Grading and Sub-Grading: The bed of the street, or streets, will be graded to the depth and cross-section as indicated on our standard typical sections of roadway for the various widths of roadway. Lines and grades will be established by the engineering department and no work will be started until said lines and grades have been set and checked. Embankments must be made of good soil, or other material, satisfactory to the engineering department, in layers not exceeding twelve inches in thickness and thoroly compacted by a ten or twelve-ton roller.

All soft and spongy material below the sub-grade shall be removed and filled with material that will readily compact and form a solid foundation, so as not to churn up under the weight of the roller referred to above. In excavation, care must be taken not to disturb the sub-foundation, except when necessary to remove any spongy material. All excess excavated material to be deposited where directed by the engineering department.

Concrete Foundation: After the sub-foundation has been prepared, as above described, a concrete foundation, as shown on typical section, will be laid by using templets as directed. The concrete is to be made of the best quality of portland cement, sand and washed gravel, or broken stone, in the proportion of one part cement, three parts sand and six parts gravel, or stone. These proportions are by volume when this material is well compacted, or shaken in the measure. The engineer shall decide all questions as to how the measures are to be filled to obtain the above proportions. All cement shall pass the standard test, with latest amendments, as recommended by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers. The sand shall be clean, sharp sand, free from organic matter, mud or other impurities. The gravel or stone shall be hard and sound and free from dust, sand or dirt, of a size that will pass a one and one-half inch ring and be held on a one-quarter inch screen. The con-



CROSS-SECTION *of standard road for Guilford district, Baltimore, Md. Note absence of curb and ample slopes from the lot lines to the gutters; also reduction of width of bituminous concrete pavement to twenty-five feet and the ample lawns on each side of the six-foot sidewalks.*


PARK
PLAT OF ROLAND
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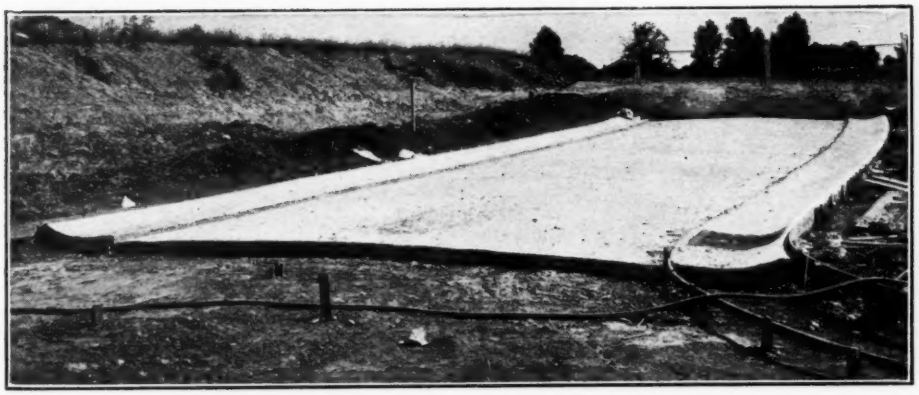
PARK
JOHNS HOPKINS UNIVERSITY
WYMAN
PLAT OF
Guilford
BALTIMORE CITY & BALTIMORE COUNTY
MARYLAND
IN
THE ROLAND PARK DISTRICT
1900 ACRES OF RESTRICTED LAND
The Roland Park Company

July, 1914



CONCRETE BASE *ready to receive bituminous concrete wearing surface.*

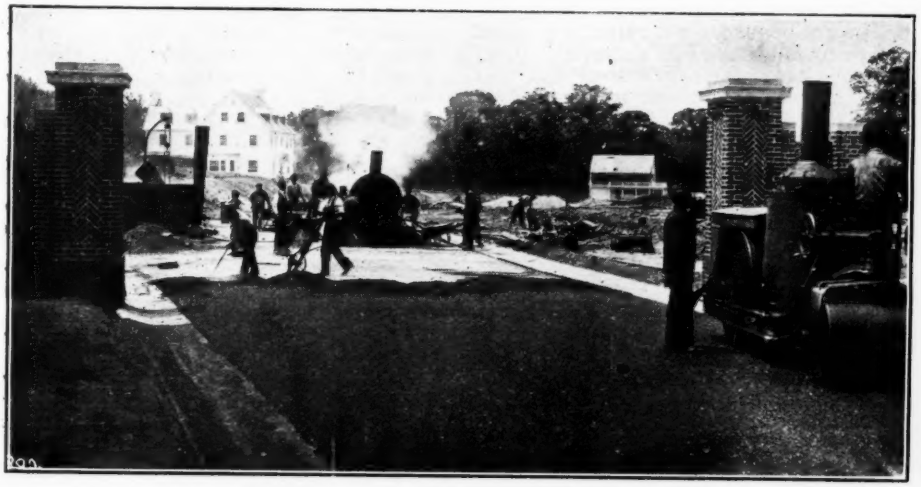
crete is to be thoroly mixed in a mechanical mixer and evenly spread on the subfoundation and thoroly rammed until free mortar covers the entire surface. If any spaces show a deficiency of mortar, such spaces are to be immediately grouted.

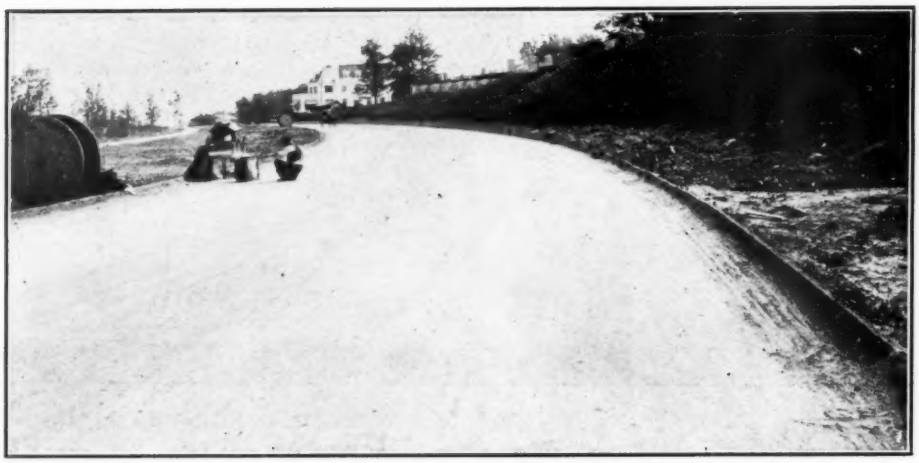
Expansion Joints—At intervals of every seventy-five feet, a half-inch expansion joint shall be placed the entire width of the street; i. e., from rebut to rebut. This expansion joint is to be filled with a heavy asphaltum filler, with a melting point of not less than 150 degrees F., as directed by the engineer.

Wearing Surface—After the concrete foundation has been laid, as above described, a 2-inch wearing surface shall be laid as hereinafter described. This wearing surface shall be composed of 1-inch crusher-run trap rock, varying in size from 1¼ inches down to dust, no piece of stone to have a greater dimension than 1¼ inches, samples of which are to be submitted for approval before delivery, and be subject to inspection at the quarry before shipment. The stone to be used in this wearing surface is to be kept dry and free from dirt.

The stone is to be charged into the mixing device, and after it has become perfectly dry, 7 per cent. by weight of the asphaltic cement, at a temperature of 290 to 325 degrees F., shall be added and the mixing shall continue until the contents of the mixer are a uniform bituminous concrete, and each stone thoroly coated and of such temperature as required by the engineer. The mixture shall be immediately placed in position on the street and spread to the proper

LAYING *bituminous concrete on cement concrete base.*





ST. PAUL STREET, *Guilford, after a year of unusually heavy traffic.*

cross-section and grade and then rolled, as directed by the engineer.

Immediately after the course has been rolled until there are no creases, or pockets, the surface is then to be given a flush coat of the asphaltic cement, not more than one-third of a gallon to the square yard being used, and applied with sprinkling pots and brooms of approved make.

The entire surface will then be spread with a coat of dry trap rock screenings, varying in size from ¼-inch to and including dust in sufficient quantity to absorb all of the asphalt cement that may appear on the surface.

This surface is then to be rolled until thoroly compact and hard. A sufficient amount of the screenings shall be left on the surface to protect the street while setting up. The percentage of asphalt cement to be used is subject to slight change by the engineer, depending upon the condition of the aggregate.

1. The asphalt cement to be used in cementing the mineral aggregate shall be similar in character to that used in the construction of sheet asphalt pavements, but sufficiently soft to permit its use with the aggregate, heated to about 250 degrees F.

2. The specific gravity of the asphalt and flux combined at 77 degrees F. shall not be less than .975.

3. It shall be soluble in carbon bi-sulphide to the extent of 98 per cent.

4. It shall be soluble in carbon tetrachloride to the extent of 97.5 per cent.

5. It shall show a flash point of not less than 350 degrees F. when tested with open cup and the fire point shall be above 400 degrees F.

6. The compound shall be sufficiently liquid at working temperature, so that when tested in an Engler vicosimeter at 212 degrees F., 40 cubic centimeters shall flow out in at least 3,600 seconds.

7. The solid contents must consist of asphalt only (not tar or acid sludge products), the consistency of the residue not being due to any other solid substance, such as paraffine.

8. The paraffine scale of the total compound shall not exceed 1 per cent., to be determined by destructive distillation (Holde method).

9. The asphalt must not be so susceptible to temperature changes that it will be brittle in winter, or soft and sticky in summer. It shall have a penetration between 70 and 85 at 77 degrees F. when tested with a No. 2 needle for five seconds, under a weight of 100 grams.

10. After heating 20 grams in an open oven for six hours at 350 degrees F., the loss shall not be over 8 per cent., and the residue when tested with a No. 2 needle for five seconds with 100 grams at 77 degrees F. shall have a penetration of not less than one-half the original, or between 35 and 43.

11. It shall be absolutely free from water.

Samples to be submitted upon request, with prices.

The cost of the construction, as above described, exclusive of grading, varies from $1 to $1.10 per square yard.

A section of the concrete base, ready for application of the wearing surface is shown by Photograph No. 3.

Application of wearing surface shown by Photograph No. 4.

Photograph No. 5 shows a portion of St. Paul street, in Guilford, which has had unusually heavy traffic for the past year.

Photograph No. 6 shows another section

A NEW PAVEMENT *of bituminous concrete. Note conformity of plan to special conditions and attention paid to beauty of layout.*

of Guilford, in which the wearing surface was just completed this spring.

The combination curb and gutter is thoroly swept and then coated with a tar product, to which stone chips are added. This form of construction is not altogether an experiment of the writer's, for in 1911 several streets were paved under practically the same specifications by contract at Annapolis, Md., under my supervision, at a cost of $1.06 per square yard. This work has given very satisfactory results and is in excellent conditio ntoday.

Concrete Roads and Streets in the United States

During 1913, concrete was actually laid in thirty-seven states and in the District of Columbia, and in thirty-eight states and the District of Columbia in 1912, and no sidewalk construction is included.

There were 907,300 square yards of all types laid in 1912 and 1913, but not divided as to years, which will account for this work being shown in a separate item in the table. In some sections, work is continued, owing to mild weather conditions, thruout the year, and no division was made as to the yardage built in each year. In other cases, contracts were awarded and work started late in 1912, and completed after the opening of the construction season in 1913, while in a few cases, reports received from various sources did not divide the yardage on some roads or streets, while this was properly divided on others.

The following table shows the amounts of paving constructed in all states in 1912 and 1913:

Type of Paving	Sq. Yds. Laid in 1912	Sq. Yds. Laid in 1913	Sq. Yds. Laid in 1912 and 1913*
One course	2,960,930	2,490,738	5,451,668
Two course	1,263,600	1,251,710	2,515,310
Bituminous top	3,331,750	1,093,608	4,425,358
Hassam	281,000	281,900	562,900
Unknown as to type	256,080	14,200	270,280
Totals	8,093,360	5,132,156	13,225,516
*To which should be added paving constructed in 1912 and 1913 and not separated as to year			907,300
Total concrete paving in 1912 and 1913			14,132,816

In the nineteen years ensuing from the laying of the first section of concrete until the close of 1911, a total of 4,303,200 square yards of concrete paving of all types was laid. In the following year, 1912, there were 5,132,156 square yards,

or an increase of over 20 per cent. But in 1913, the total reached 8,093,360 square yards, or an increase of 57.7 per cent. over 1912. None of the 907,300 square yards of paving laid partly in each year is included in these figures, so that as most of this 907,300 yards was laid in 1913, the increase is conservatively estimated at 75 per cent. over 1912.

During the present year, from reports that have already been received, there will be a still greater ratio of increase. As there have already been either contracted for, or positively decided upon, over 14,000,000 square yards of all types of concrete paving, there is no hesitation in estimating that there will be at least 18,000,000 square yards laid in 1914. New York state is already preparing to build over 120 miles of concrete, Ohio builds 24 miles in one section in Muskingum and Licking counties, California expects to at least double and probably triple the 1,766,000 yards constructed last year, and nearly all of the other states that have already reported, advise that they will make substantial increases over the figures for last year.—*Better Roads.*

Better Roads Cut Living Cost

The building of good roads is the most important factor which this country must consider in the next few years. The improved highway is the one means of salvation for the poor man, for in these days of high cost of living, we must look to the cheaper transportation of food stuffs as our way out. We can no longer expect to better our condition thru a greater supply of necessities, for every effort we have made toward lowering the cost of food stuffs heretofore has been met with the response that the United States is now about as intensively cultivated as it can be under present conditions.

In other words, our people are no longer turning to the country in an effort to produce a larger amount of food. Therefore we must face the problem of getting along with the same amount that is now produced.

The only solution left for us is to cut out cost of production and delivery. The best way to accomplish this is to provide good roads, for we have already had many demonstrations of how good roads will work to our advantage.

The improvement of highways in many parts of our country in the last few years has been invariably followed by better living conditions. Where the roads leading into a large city have been improved we have seen an increased supply of food stuffs on the local markets and a larger number of farmers bringing their products into the city. This, of a necessity, results in lower prices for the products and a long step toward better living conditions.

On the other hand, the improvement of roads thruout the country is invariably followed by an improvement in farming methods. The agriculturist who heretofore devoted his energies to grazing and the production of rough food stuffs, such as corn, is now turning to what is known as market gardening. He is raising potatoes, beans, peas and other commodities that are in every day demand, simply because he can get them to market where heretofore markets were denied him. It is no uncommon sight now to see farmers driving eighteen or twenty miles to market with loads of produce which before the highways were improved were denied the consumer. The automobile, it is true, has had a great deal to do with increasing this supply, but even this vehicle would be helpless without highways on which to run.

The advent of good roads, too, has brought about another revolution, that of intensive farming. The countries of the old world have always regarded us a criminally wasteful people, in that the product raised on 100 acres of land in this country was often less than they produced on ten acres. Good roads have changed this condition. The American farmer now finds that he will get a greater return from one acre of land intensively cultivated than ten acres farmed in the old slipshod methods would heretofore produce. This intensive farming is the direct result of good roads, for where the farmer heretofore found it necessary to cultivate crops which made a large bulk so that his infrequent trips to market were profitable, he now finds that he can take a small load to the consumer as often as he desires.

Good roads are an undisguised blessing, and this every one who has given the matter any thought will admit. They not only promote increased industrial activity, and therefore better the living conditions of thousands of our city dwellers, but they provide an improved social life for people who live in the country. The family which has access to a good road, and therefore quicker and more pleasant trips, goes to church oftener, visits the neighbors oftener and attends farmer club meetings more frequently. No one can deny that all of these are important factors in the farmer's life.

Good Roads in Fairfax County, Va.

Fairfax County, Va., will build 33 miles of tar macadam roads in the Mount Vernon district, work having been begun by the contractors. The county voted $90,000 in bonds for the work last fall, the state contributes $10,000 and the United States government contributes $16,000, the total cost being $116,000.

Municipal Notes

Water Filtration for Detroit

Theodore A. Leisen, who has just assumed his new duties as the chief engineer of the water works of Detroit, Mich., states that the next great improvement needed in the system is a filtration plant, the cost of which, for the 200,000,000 gallons a day capacity required, he estimated at $2,000,000 to $3,000,000.

Detroit is now using hypochlorite to some extent, but Mr. Leisen does not consider it a substitute for filtration, but rather as a supplementary treatment. He also recommends sewage purification for the city.

Mr. Leisen comes to Detroit from the Louisville water works, of which he has been superintendent and engineer for several years, and he succeeds Geo. H. Fenkell, who was appointed commissioner of the department of public works some months since.

Muscatine, Iowa, Investigates Municipal Lighting

Prof. J. B. Hill, of Iowa City, has reported to the City Council that to make a new municipal electric lighting plant a success financially, including all capital charges, it would be necessary to charge the city $80.07 per arc lamp per year, $27.34 per tungsten lamp, and $46.60 for five-light electrolier, and to receive from private customers 11.7 cents per kilowatt hour. This is practically the same that the city is paying at present for arc lamps and $2.34 more than it is paying for gas and gasoline lamps. These figures are for a load factor of 13. If the time of using electricity can be increased so that the load factor can be made 20, the lighting peak remaining the same, 352 kw., the combined load factor with the street lights will be 24.9 instead of 19.3, as in the above estimate, in which case arc lamps would cost $76.60 per year, tungstens $26.25 and five-light electroliers $44.86.

On the latter assumption the average price to private consumers must be 8.05 cents per kw. hour.

The Muscatine Lighting Company has the advantage of a railway load, so that it can offer the new price of $65 per arc lamp, and should, according to Prof. Hill, make the 100-watt tungsten price $23 a year. He also recommends that the primary private current rate be reduced to 11½ cents net per kw. for the first 30 hours' use.

Denver Commission Government

The semi-monthly publication of the city of Denver, which is free to taxpayers on request, in its issue dated June 13, 1914, has a statement from each of the commissioners regarding the first year's work under the commission form of government.

Commissioner J. B. Hunter, of the department of improvements, shows a reduction in the total expenditures for maintenance and operation, of nearly $200,000, most of which is due to reduction in expense of street cleaning and repair, and special flood repair and boulevard funds. He shows a similar reduction in cost of improvements paid for by special assessments, tho four-fifths of these expenditures were provided for by the preceding administration. The commissioners in charge of the departments of safety, social welfare, finance and property make general statements, mainly showing that the first year was less than a half year under the new form completely and results must not be expected for another year.

The finance department shows a reduction of $20,000 in the amount used in operating the six departments under his charge in 1913 from that used in 1912 under the old form of government, and a further reduction in amounts appropriated for use in 1914 of over $40,000.

The auditor devotes his statement to criticisms of the provisions of the law which show lack of familiarity with the needs of municipal government, which he summarizes as follows:

"We need an executive head and fixed responsibilities, a mayor and comptroller, and men of fixed policies and nerve to lead—and if necessary to lead alone.

"Specifically, an unnecessary $12,000 city newspaper, an unnecessary $6,000 mayor's office and no mayor, an over-officered and expensive charity bureau, an expensive tho beautiful and distant poor farm. Too many automobiles and chauffeurs. Lack of a store house for supplies, making waste and increased cost. An expensive and poorly administered health department. Inefficient revenue and license ordinances. Too many employes in nearly all departments and in the courts. Lack of equalization of salaries as compared with responsibilities attached thereto. Too many independent commissions and courts and officers with power to incur liabilities against the city. The lack of an independent city attorney, who, being appointed by the commissioners, must do their will. Too many boards and and officers under the commissioners supposed to have been abolished, thus shirking and dividing responsibility and increasing expenditures."

Commission Government in Grafton, W. Va.

Grafton, W. Va., in response to a request from Mount Pleasant, Mich., has sent full information about the present form of government with a statement that it is meeting with general approval. Mount Pleasant is considering the commission form and the city manager form of government.

A College of Engineering on the Co-operative Plan

The College of Engineering of the Municipal University of Akron was established in 1914. Applicants will be assigned to shop work in July, 1914, and accepted as students in September, 1914.

The "Cincinnati plan" has been adopted and offers a five-year co-operative course in engineering. This requires the practice of engineering to be learned under actual commercial conditions, and the science underlying this practice to be taught in the university by trained educators. Its aim is to give the student a thorough training in both the theory and the practice of engineering. The students are grouped in two sections, one of which is at work and the other in attendance at the university. Thus, during any weekly or bi-weekly period, one-half of the students are at the university and one-half are in the shops. At the end of the period, those who were at the university go to the shops, and those who were in the shops go to the university.

Five years of eleven months each are required to complete the course. Each student is allowed a vacation of one week at Christmas time and three weeks in the latter part of the summer.

The number of students that can be accepted in the fall of 1914 is limited, both by the positions open in the factories of Akron and by the facilities of the University; therefore, applications for admission should be filed with the Dean of the Engineering College before July 1, 1914. Students applying after that date will be admitted if any positions remain open, or if any vacancies occur due to resignations.

While a student is at work, he is subject to all the rules and regulations imposed by his employer upon the other employes. All existing labor laws and conditions, including those pertaining to liability for accident, apply to the student the same as to any other employe.

In order to operate a co-operative course in engineering, the Engineering College must be located in or near an industrial center. Akron, O., is essentially a manufacturing center, and this type of engineering education was selected as being the latest and the one best adapted to the city's needs. No other courses in engineering will be offered.

Concrete Trestle in California Highway

The engineer's estimate for the construction of the trestle described in the June number of MUNICIPAL ENGINEERING, vol. xlvi, p. 517, was $215,634.06.

Bids were opened on June 8 and the lowest bidder was the Sound Construction and Engineering Co., of San Francisco, at $238,823.82, for pile substructure with the deck cast in place instead of in slabs as described in the article referred to. The bid on the 2,318 feet of timber trestle was $11.95 a foot; on the 13,851 feet of concrete trestle was $13.72 a foot. To each of these must be added the asphalt surfacing of the roadway, on the 32,230 square yards of which the bid was 65 cents a square yard. The 20 monuments were bid at $14 each.

The highest bid was for use of the Thomas unit system with 34-foot spans between bents, $397,069.60.

Sterilization of Water Supply of Erie, Pa.

During 1913 all the water supplied to the city of Erie, Pa., was sterilized by the use of calcium hypochlorite, altho, on account of the excellent bacteriological con-

dition of the lake water during the summer months, the use of the sterilizing solution was precautionary rather than necessary.

Once, early in December there was objectionable taste and odor in the water due to the hypochlorite. This occurred because the sudden chilling of the water caused a slow breaking up of the sterilizing solution, which was being used at that time slightly in excess, because of the excessive stirring the lake had received during heavy wind storms.

The proportion of hypochlorite used averaged 7.35 pounds per million gallons during the year. The monthly average efficiency of the process from April to December, inclusive, is shown by the percentage of bacteria removed, which varied from 88.7 per cent. in October, to 96.9 per cent. in May. The cost of the 45,136 pounds of hypochlorite used was $595.81, and the cost of treating the water averaged 74.6 cents per million gallons.

All the water used passes through settling basins, which remove from 16.7 to 50 per cent. of the turbidity, averaged by months. A filtration plant is completed and put in operation this year.

Sewer Excavation With a Revolving Shovel

George Hyman, of Washington, D. C., has been operating a revolving shovel for digging sewers in and about the city of Washington. The success which he has attained makes it well worth while to study his method of operation.

The shovel is equipped with a 27-foot handle, enabling it to dig to a depth of 18 feet, below the bottom of the wheels. The dipper has a capacity of ⅞ of a cubic yard. It is fitted with five forged teeth, three on the front, and one on each side. These teeth are intended as side cutters in order to assure sufficient clearance to lower into the ditch easily after a cut has been made. The neatness of the ditch cut is very noticeable.

Mr. Hyman has used this machine recently for digging ditch for sewer pipe and also for concrete and brick sewer. The most recent job was a ditch for an 18-inch sewer pipe. This ditch is 3,300 feet long, varying from 10 to 27 feet in depth. The material is hard clay with a little shale at the bottom. As some of the work was done when the bottom was somewhat frozen the digging was very hard.

For the concrete and brick sewer, the shovel excavated a trench 18 feet deep, seven feet wide at the top and an average of five feet at the bottom. This sewer had a concrete invert and a brick arch. The speed of the building of the invert and the brick arch governed the whole progress of the work. The shovel under these conditions made about 65 feet advance a day, but this naturally is not an index of its capacity.

The material was loaded into two-yard side-dump cars traveling on light rails laid alongside the trench. This material was hauled back and dumped directly into the backfill. This method was pursued whenever possible. In a few places, however, owing to local conditions, it was necessary to overcast a small amount of material, which was later rehandled. The excess material not required for backfill was taken away in wagons. The bracing of the trench was put in by hand and small jack screws at the ends of the blocks held the sheeting in place.

Two men were used for pushing the cars, altho at times a mule was employed.

The concrete invert was laid immediately back of the shovel in the trench dug by the shovel on the preceeding day. The brick arch was built on the second preceding day's invert and was allowed to stand a day before the backfill was placed upon it. This, as will be seen, left 200 to 300 feet of open excavation. Hence it was necessary only to keep the shovel ahead of the concrete gang.

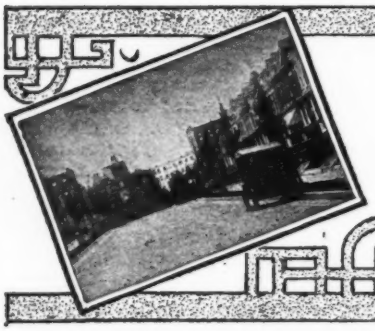
The organization of the job was so well planned, that a very few men were employed.

The shovel is mounted on traction wheels, to which are riveted circumferential bands formed of channel iron, which give a double flange on the wheel. The shovel runs on rail sections about three feet long, mounted on 12x12-inch timbers. These timbers, seven in number, span the trench. They are in reality long chair ties. In order to move forward a chain sling, hung over the dipper handle, was hooked into I-bolts in the chair ties, or timbers.

Mr. Hyman deserves much credit for the efficient organization of his jobs.

Consumption of Wood Preservatives in 1913

Statistics compiled by the National Wood Preservers' Association in cooperation with the U. S. Department of Agriculture show that during 1913 the consumption of wood preservatives by the 93 treating plants reporting amounted to 108,373,351 gallons creosote oil, 26,466,803 pounds dry zinc chloride, 3,883,738 gallons miscellaneous liquid preservatives, and relatively small amounts of corrosive sublimate. Compared with 1912 there is shown an increase in consumption of 29.5 per cent in creosote oil, 27.5 per cent. in zinc chloride, and 26.46 per cent. in miscellaneous liquid preservatives.



MISCELLANEOUS

The Society for Electrical Development

The Society for Electrical Development held its second annual meeting on June 1 at the Bellevue-Stratford hotel, Philadelphia, Pa. J. M. Wakeman, general manager of the society, reported that the best men available to carry it on had been secured. This work has been divided into sections as follows: Field co-operation, new development, commercial exchange bureau and editorial and advertising. The activities of the society are well directed by the following staff: George Barton Muldaur, M. E., is in charge of the work of the first section and Robert N. Lee has been engaged to assist him. Mr. Muldaur will travel about the country forming co-operative leagues for more intensive local development of the industry, aiding architects and builders to arrange for complete electric service instead of lighting alone, bringing textbooks and lecture courses up-to-date, etc. John P. Mallett, M. E., will investigate the present uses of electricity in various industries and report how these applications can be extended. Theodore Dwight, who is in charge of the commercial exchange bureau, will secure and index information regarding the uses of electricity. This information will be at the service of the members of the society. The editorial and advertising department is in charge of H. C. Spaulding. L. G. Harkness-Smith has been placed in charge of a department which will aim to illustrate by means of motion pictures the uses of electricity in the home, mill, factory and farm. A window trimming department has also been organized and placed under the supervison of A. J. Edgell. Sample electrical displays are being set up in windows and photographs taken and distributed among the members of the society. Printed instructions on how to trim the windows are sent with the illustrations.

Mr. Wakeman further reported that the society membership consisted of 298 central stations, 186 manufacturers, 272 jobbers and dealers, 588 contractors and 23 miscellaneous industries. He said that the society was still desirous of increasing its membership in order that the development work may be made more extensive.

The following members of the board of directors were elected: To represent the central stations, J. E. Montague, Niagara Falls, N. Y.; manufacturers, H. B. Crouse, Syracuse, N. Y.; jobbers and dealers, Fred Bissell, Toledo, Ohio; and contractors, G. M. Sanborn, Indianapolis, Ind., each to serve four years.

The following officers were elected: President, Henry L. Doherty; first vice-president, W. H. Johnson; second vice-president, A. W. Burchard; third vice-president, W. E. Robertson; general manager, J. M. Wakeman; acting secretary-treasurer, James Smieton, Jr.

Technical Associations

The meeting of the American Society of Engineers, Architects and Contractors at its meeting July 3 will discuss industrial accidents, concrete house construction, and related subjects, and on July 4 will devote its time to good roads.

The eighteenth annual convention of the Central States Water Works Association will be held at the Windsor Hotel, Wheeling, W. Va., Aug. 25, 26 and 27. R. P. Bricker, secretary, Shelby, O.

At its meeting June 10, the Ned York Electrical Society listened to a paper by William P. Kennedy on the electric vehicle in New York City and elected Frederick. A. Scheffler as president and George H. Guy as secretary.

The Federation of Trade Press Associations will meet at Congress Hotel, Chicago, Sept. 24, 25, 26.

The Chicago cement show will be held in the Coliseum Feb. 10 to 17, 1915. This will be the only cement show held by the organization in 1915.

The Atlanta convention of the American Highway Association will be held Nov. 9 to 14.

The second international safety exposition will be held at the Grand Central

Palace, New York City, December 12 to 19, under the auspices of the American Museum of Safety, 29 W. 39th St.

Technical Schools

The Iowa Engineering Experiment Station was established at the Iowa State College by the Legislature of Iowa in 1904, to meet the demands made upon the college by industrial, urban, and agricultural interests for information and assistance. Since its creation, its growth has been rapid, and the demands upon it have more than justified its existence. From the first the station has carried on original investigations along lines of vital interest to the people of Iowa, and has published the results in bulletin form for free distribution. The station is constantly receiving from cities, counties, corporations, and individual citizens of Iowa, samples of cement, brick, tile, sewer pipe, asphalt, iron, steel, wood, stone, gravel, sand, clay, cement materials, fuels, water, sewage, etc., with the request that they be tested or analyzed, and the results reported. The volume of such work is increasing, and more and more the Engineering Experiment Station is coming to be considered the final authority to decide many questions of quality of materials, or the value of fuels, clays and other materials. For such tests, the station makes low charges, just safely covering the actual cost of the work. The station is equipped to make practically any test desired, and has on its staff men whose knowledge and experience fit them to advise upon all phases of industrial and engineering work, including civil, illuminating, mining, mechanical, electrical, and agricultural engineers, industrial chemists and ceramists.

"Tests of Bond Between Concrete and Steel," by Duff A. Abrams, has just been issued as Bulletin No. 71 by the Engineering Experiment Station of the University of Illinois. In designing structures of reinforced concrete it is important to know the amount of stress which may be developed between the surface of the reinforcing bars and the surrounding concrete before failure is produced by the slipping of the bars. This stress is what is commonly termed "bond." The abovementioned bulletin gives the results obtained by pulling out bars embedded in blocks of concrete and also the results of tests made to study the bond stresses developed in large reinforced concrete beams. Nearly 2000 tests are reported and a wide range of conditions are represented. This is one of the most exhaustive studies of the amount and distribution of the bond stress between concrete and steel which has appeared.

"The Tractive Resistance of a 28-Ton Electric Car," by Harold H. Dunn, has just been issued as Bulletin No. 74 of the Engineering Experiment Station of the University of Illinois. It records the results of tests made to determine the tractive resistance of a 28-ton electric car when running on straight track in still air. The tests were planned so as to eliminate wind resistance. The results are finally expressed in the form of a curve whose co-ordinates are car resistance and speed, which shows that the resistance varied between 5.25 pounds per ton at 5 miles per hour, and 26.12 pounds per ton at 45 miles per hour. The bulletin contains also a description of the car.

A course in engineering administration is added to the curriculum of the Massachusetts Institute of Technology, in which three-fourths of the time is devoted to engineering and scientific branches and one-fourth to business subjects, including the fundamental principles on which modern accounting is based, cost keeping, characteristics of various investments, transportation, industrial organization, business management and business law. The engineering studies may be taken in the civil, mechanical, electrical or chemical courses.

The Massachusetts Institute of Technology has established courses in highway engineering in the department of civil and sanitary engineering under the general supervision of Professor Charles M. Spofford, the head of the department and in charge of Professor Hector J. Hughes. These courses are for undergraduates rather than being for postgraduates.

Publications Received

Lefax sheets for May, June and July cover natural gas, mine accidents, ores, surveying, hydraulics, cement, logarithms, plate girders, steam turbines, bolts, mechanical and electrical engineering, earth work and radium. Standard Corporation, Pennsylvania Bldg., Philadelphia.

A new series of data cards is issued by The H. A. Strauss Data-Card Service, Harris Trust Bldg., Chicago, Ill.

The June issue of "Data," published by Engineering Contracting, Chicago, Ill., carries the number of sheets to 1088.

Preliminary Report to the Mayor and Aldermen by the Chicago Municipal Markets Commission. Frederick Rex, secretary, 1005 City Hall.

The City Manager Plan of Municipal Government, reprinted from Beard's Loose Leaf Digest of Short Ballot Charters, 36 pp., 25 cents.

Report of the Public Service Commission for the first district of the State of

New York, Vol. II. Statistics of transportation companies for year ending June 30, 1912. A. I. Weber, chief statistician, New York City.

Forty-seventh annual report of the Commissioners of Water Works of Erie, Pa., for years 1913. E. J. Morton, civil engineer.

Decision of the Supreme Court of the United States in the Kansas rate regulation case, together with the dissenting opinion. Issued by T. R. Weddell, secretary, 160 W. Jackson Blvd., Chicago, Ill.

The proceedings of the 33d annual convention of the American Water Works Association, held at Minneapolis, June 23-27, 1913, fill a cloth-bound volume of 750 pp., full of good material. John M. Diven, secretary, Troy, N. Y.

The proceedings of the 9th convention of the Natural Gas Association of America, held at St. Louis, May 19-22, 1914, are very prompt in their appearance.

The proceedings of the tenth convention of the American Road Builders' Association, held at Philadelphia, Pa., Dec. 9-12, 1913, have been received. E. L. Powers, secretary, 150 Nassau St., New York City.

Ninth annual financial and departmental report of Edmonton, Alberta, for 14 months ending with 1913. A. J. Latornell, city engineer.

Annual report of the commissioner of public works of St. Paul, Minn., for 1913. Oscar Claussen, commissioner.

Unpopular Government in the United States," by Albert M. Kales, professor of law in Northwestern University. Cloth, 272 pp., $1.50 plus postage on 24oz. University of Chicago Press, Chicago, Ill. Showing the rise of the "politocrats" and how unpopular government was established in this country, and methods in use and in process of development for restoring popular government.

Report of the Investigations on Drain Tile of Committee C-6 on standard tests and specifications for drain tile, of the American Society for Testing Materials, published as Bulletin 36 of the Engineering Experiment Station at Ames, Iowa.

Proposed charter for the city of St. Louis, prepared by the Board of Freeholders elected by the people, April 1, 1913. Wilbur B. Jones, secretary, 329 Municipal Courts Building, St. Louis, Mo.

Report of Board of Public Works of Little Falls, N. Y., for 1913. O. J. Dempster, city engineer.

Brown's Directory of American Gas Companies, ($5) for 1914 is a cloth bound volume of over 800 pp., containing all sorts of information and statistics concerning gas companies, artificial and natural, acetylene and gasoline, parent or operating companies, public service commissions, prices of gas securities, operations of prominent companies, associations of gas men, books on the subject, etc. Published by The Gas Age, 280 Broadway, N. Y.

Civil Service Examinations

The U. S. Civil Service Commission will hold examinations at the usual places, as follows:

July 8—Assistant physicist in Bureau of Standards, at $1,400 to $1,800 a year. Landscape architectural draftsman in Engineering Department at large, at $900 a year. First-class steam engineer for position of assistant engineer and electrician, at $1,200 a year.

July 13—Metallurgical engineer for work in iron and steel, in Bureau of Mines, at Pittsburg, Pa., at $3,000 to $4,500 a year. Assistant mining engineer in the field, Bureau of Mines, at $1,800 to $2,400 a year.

July 22—Transitman in Forest Service in Southern Appalachian and White Mts., at $800 to $900 a year.

July 22, 23—Mechanical draftsmen for Panama Canal service, at $125 to $150 a month.

August 3—Chemical engineer in Bureau of Mines at Pittsburg, Pa., at $2,400 to $4,000 a year.

Personal Notes

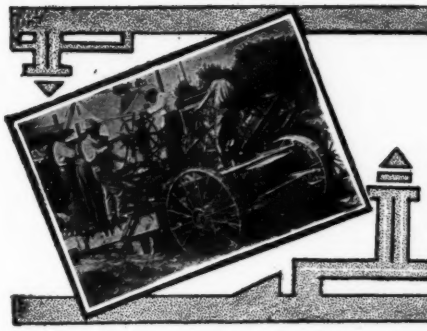
Hering & Gregory, consulting engineers, New York City, have been retained by the Board of Contract and Supply of Albany, N. Y., to investigate and report on the best method of collecting and disposing of the garbage, rubbish and ashes of the city.

C. E. Hix, recently superintendent of the power plant at McColl, S. C., has gone into the business of electrical contracting at Spartanburg, S. C., as manager of the Spartan Electric Company.

Mr. Keppelle Hall, who for the past fifteen years has been actively engaged in engineering work of considerable magnitude, has joined the organization of Sanford E. Thompson, consulting engineer, Boston and Newton Highlands, Mass.

C. W. Boynton, formerly with the Baltimore & Ohio Railroad, and for the past ten years inspecting engineer of the Universal Portland Cement Co., has resigned his position to take charge of construction and operation for the Sonoma Magnesite Co. in developing its properties in California.

W. M. Kinney, assistant inspecting engineer, who has been in charge of the Universal Inspection Bureau in Pittsburgh during the past six years, has been selected by the Universal Portland Cement Co. to take up the work left by C. W. Boynton.



MACHINERY AND SUPPLIES

Efficiency in Road Building Equipment

In these days when good, permanent roads and streets have become such an absolute certainty, paving machines many and various in style and build are being placed upon the market. Naturally, street and road contractors are keeping their eyes wide open, and are grasping with intense interest every feature fo advantage which goes into the making of such machines, all being carefully studied as brought out.

The M-C rail-track paver, manufactured by the Marsh-Capron Mfg. Co., of Chicago, is attracting a great deal of attention, because of its simplicity, its ease of operation, its strength, and the general service it is giving in street and road work. The company are very enthusiastic about its future, and the words of commendation and congratulation they are receiving from contractors and engineers throughout the country, cause them to believe that their machine is just what the contractors have long been waiting for.

For a number of years the Marsh-Capron Company have been manufacturing concrete mixing machinery for building work. They started out with the determination to give the contractors full value for their money and it was not until they had carefully studied the needs of the building trade and learned just what contractors were up against that they commenced operations. Their machines have been acknowledged everywhere successful.

Among the advantageous features, patented, are the steel rail tracks which are placed around the drum. The company spent much time and many thousands of dollars in perfecting this wear-proof feature, and all their equipment now, as the name "rail-track" implies, is furnished with these rails as a protection for the drum.

Roller-bearing, dust-proof car wheels for the steel tracks to roll on is another unusual and effective feature. These mean easy operation, and will last indefinitely, without bother or attention.

A feature of great importance is the segmental gear, and no one appreciates the value of this more than the contractor who has had the misfortune to have broken this part of his mixer. When the gear is cast in one piece and a break occurs, much time and money is required before the mixer is again ready for operation, but when the gear is cast in segments it is an easy matter to replace a part, should it become broken, and the cost is trivial.

Submerged grease cups mean easy lubrication without the annoyance of having to watch them to see that they are not filled with dust or concrete.

The accompanying picture shows the M-C rail-track paver on the job in Wilmette, Ill. Note carefully its difficult position. It is in just such cases as this, the manufacturers say, that the machine best shows its worth.

Paving an intersection naturally calls forth all the flexibility and speed of the best paver. The facts that there are four corners to be laid, and that concrete sets quickly, make it difficult, unless the machine is especially efficient and easy to handle, to connect all the ends into a perfect and continuous stone, before any of it has set.

In the picture will be noted (1) that the north end of the street has just been finished. The paver is now working on the short stub of the west side (4). When this is finished it will turn end for end and do the east side stub (2). Then the block to the south (5) will be laid.

An obstacle that would have puzzled most operators is the manhole (3), which interferes with the paver moving in a straight line from one position to another. It was accomplished in this instance with comparative ease.

It is generally known that specifications for roads vary in different parts of the country, in accordance with the various traffic conditions that must be met. Contractors' methods in laying concrete pavement also vary considerably.

M—C RAIL TRACK *paving mixer at work at Wilmette, Ill., showing order of construction of street intersection at treatment of manhole.*

Concrete mixers for paving work are called upon to meet many different conditions, and it is the aim of mixer manufacturers to make their machines as flexible as possible. A paving mixer must be able to lay anything from a city street 40 feet wide to a 12-foot country road, and it must be able to do this in the most convenient and efficient manner. The same type of distributer that is necessary on very wide streets is, naturally, entirely unadapted for narrow roads.

The M-C rail-track paver is built with the idea in mind of giving the greatest convenience in road and street work. The mixing distributer, for wide streets, is a remarkable piece of machinery, doing away with bucket arrangement, and guaranteeing more mixing, because the concrete after it leaves the mixer drum is conveyed thru this distributing trough by means of a worm conveyor, which mixes as it delivers. Delivery is expedited by means of four gates in the bottom of the trough, opening at four points, about 4 feet apart. The concrete is, therefore, deposited in just the right proportion, and at just the right distances to make its handling most convenient. The distributer is a simple piece of mechanism, requiring no expert to manipulate it successfully. In fact, one of the cheap labor hands on the street can easily take care of the levers which let down the concrete as desired.

For road work and for streets up to 24 feet wide, a simple steel chute is provided as the most efficient distributer. This is furnished in various lengths to suit conditions, the general call being for the 8 and 10-foot sizes. The 10-foot delivery chute of the M-C paver hangs on an incline of approximately one in three. The 8-foot chute, of course, is a little steeper than this.

The Marsh-Capron Company contend that a three-to-one slope is just as flat as can be used to advantage on a paving mixer. The cry is now for medium dry concrete. To quote the words of Prof. Blanchard in the paper he presented at the National Conference of Concrete Road Building: "The amount of water in the concrete should be such as to cause it to settle to a flattened mass—but not sufficient to cause it to flow readily on the sub-grade. The consistency should be such as not to require tamping, but not so wet as to cause a separation of the mortar from the coarse aggregate in handling and placing. If there is an excess of water on the surface, or the mass has a tendency to flow or settle out of position after being floated, the concrete has been mixed too wet."

The Marsh-Capron engineers contend

that concrete of the consistency advocated in this paragraph will not flow on a chute that has not an incline of at least one in three. It is true in some building operations, in which concrete is placed in the forms by spouts several hundred feet long, that the concrete is mixed wet enough to flow on a one in four, or even on a one in five slope, but such concrete is entirely too wet to meet the best practice in concrete road work.

Many concrete roads are being laid in two courses. The first course, 5 or six inches thick, is laid; then, as a rule, strips of reinforcing wire or expanded metal are laid on the top of this course. The finish of the top or wearing surface is then put on and floated. This top surface is generally 2 inches in thickness.

There are two ways in which the work of laying a 2-course road can be done economically. First, with two mixers. The regular paving machine will go down the street and lay the first course. A couple of men will follow, putting the reinforcing in place. A second machine, of a much smaller type, such as the "Little Devil" mixer (which is also manufactured by the Marsh-Capron Mfg. Co.), follows, mixing the top surface and operating at the side of the road. These machines are light and easily moved, and their daily capacity is ample for the small amount of wearing surface they have to mix.

The other method of laying 2-course road consists of doing both the bottom and the top course with the one machine. In this case the mixer should be fitted with a device like the 16-foot mixing distributer supplied by the Marsh-Capron Mfg. Co. The method then is to lay the first course on 12 to 16 lineal feet of road. The reinforcing is placed immediately on top of the first course, and the mixer is then charged with the proper aggregates for the finishing course. The mixer then goes ahead 12 to 16 feet and another section is laid.

By this method the mixer is moved twice for each 25 feet of stone, or three times for stones 35 feet long between expansion joints. The yardage per day by the second method is not so great as where two mixers are used, but there is not such a big investment in equipment and not so many men are required, altho the cost per yard, as a rule, runs a little higher.

The second method has the advantage of the top course being laid before the first course has had any chance at all to set, and the results are generally satisfactory.

On country road work machines operated by gasoline engines are very popular, as the trouble of hauling a fuel and water supply is overcome. In country districts the water obtainable is very often not the best for boiler feed, and the gasoline engine, therefore, eliminates the dirty, scaly boiler, which would considerably reduce the efficiency of the outfit.

M—C PAVING MIXER, *showing distributing trough, discharging at four points along its length.*

The M-C rail-track paver is fitted with a 12-horse-power gasoline engine, which is not only sufficient to operate the machine while mixing, but is of considerable advantage when moving the machine, by means of its own traction gearing, on bad or hilly roads.

This tractive power is really the same as is found on heavy autotrucks and traction engines, and the machine is equipped with both a high and a low running gear. The low speed (one-half mile per hour) enables the operator to do the most effective work while laying concrete, moving only a few feet at a time, and also when traveling on bad roads, in climbing hills and in pulling out of difficult places on the highway. Shock absorbers prevent strain or danger, and the machine is further provided with a strong set of brakes, which makes it easy to move the mixer safely down grade.

No point has been overlooked in the traction end of the M-C paver. The wheels are extra heavy and of great strength and the frame is made in such sturdy manner that absolute rigidity is assured, no matter how much traction pull is required.

The high speed of the M-C paver is 1¾ miles per hour, and on good roads there is little delay in getting from one job to the next. The tractive power of this paver is such that no horses are ever needed to pull out of bad places or up a grade—a feature which most appeals to men who have been stuck on the way to work, and have lost much time and patience in getting started again.

A further feature of great value in the M-C rail-track paver is the differential gear which is furnished in the traction drive. This insures against strain of the machine, and is really so essential that the biggest and best posted contractors and engineers insist upon having their machines so equipped.

As the picture shows, the M-C paver is able to pull out and around obstacles easily and quickly. The steering is easy, and the operator has a clear view both ahead and to the rear. All levers are arranged at his fingers' ends, and there is no stretching or bending to make the days' work difficult. Handling the M. C. rail-track paver, the manufacturers claim, is so easy that engineers "scrap" for the job.

The M-C rail-track paver did the work on the job shown in the picture, altho under tremendous disadvantages, at the rate of 100 square yards per hour of concrete paving 7 inches thick. Old-time contractors and engineers who were there for the demonstration positively declared that they never had seen its equal, and further stated that the intersection itself was the best they had ever seen.

Stopping the Water Waste

"It is astonishing," said an engineer who had been investigating water consumption statistics, "that there is such a remarkable difference between the gallons per capita used in various cities. The maximum is 398 gallons, the average 121, the minimum 26. This illustrates the tremendous wastage, especially in locations where meters are not used. It has been found that by far the greatest per cent of loss is due to leaky faucets."

In this connection it is interesting to note the appearance on the market of a new washerless faucet which puts an end to leakage. This device is fitted with a conical valve bearing directly on a spherical seat. This gives a line contact which makes a tight joint, so it is not necessary to jam the handle in an endeavor to stop leakage. This new faucet should be of decided interest to owners of hotels, factories, or large establishments, where the water bill is a considerable item.

Householders also will find it a boon, as a leaky faucet not only means plumbers' bills, but also the disfigurement of bowls and tubs with an unsightly yellow stain.

This washerless faucet is in extensive use abroad and has been authorized by the London Water Board. The manufacturers, the H. W. Johns-Manville Co., New York, state that the American sales are mounting fast and making new records each month.

The Harris Municipal Garbage Incinerator and Steam Generator

Dr. J. B. Harris, the inventor of one of the most satisfactory smoke prevention furnaces in operation, has also invented and designed a line of high temperature destructors of city refuse, which can be built in single units of 10 tons to 25 tons capacity per 24 hours and in quadruple units up to any desired capacity, generating 100 to 1,000 h. p. per unit from special self-contained water-tube steam boilers and superheaters.

United States patents were allowed in March of this year and the Canadian patents were allowed and issued on March 24. Dr. Harris will sell the Canadian patents and would like to hear from interested parties at his office, 65 Life and Casualty Bldg., Nashville, Tenn.

New Lufkin Catalog

The Lufkin Rule Company announced the issuing of their new catalog, No. 9, now ready for distribution. Its 110 pages are devoted exclusively to measuring tapes and rules and it unquestionably is

the most complete catalog of such goods ever sent out. The various items thruout the book are well arranged and most comprehensively presented. The embossed cover is of strikingly original design, executed in the Lufkin stock label and box colors, tan and maroon. Special attention is invited to the fact that in addition to measuring tapes and steel rules, which lines the company has manufactured for the last twenty-five years, they now have ready for the market a complete line of folding boxwood, and flexible spring joint wood rules. Requests for copies of the new catalog will receive prompt attention and should be addressed either to the Lufkin Rule Company, home office at Saginaw, Mich., or New York office at 106 Lafayette street.

Montreal's Portable Asphalt Paving Plant

The accompanying photograph shows a Cummer one-car portable asphalt paving plant in operation in the city of Montreal, Quebec, Canada. This plant is turning out sheet asphalt at the rate of 2,000 yards of 2-inch top per day.

As the city of Montreal intends laying this year some miles of sheet asphalt, they are keeping this plant busy every minute.

Kissel-Kars as Fire Fighters

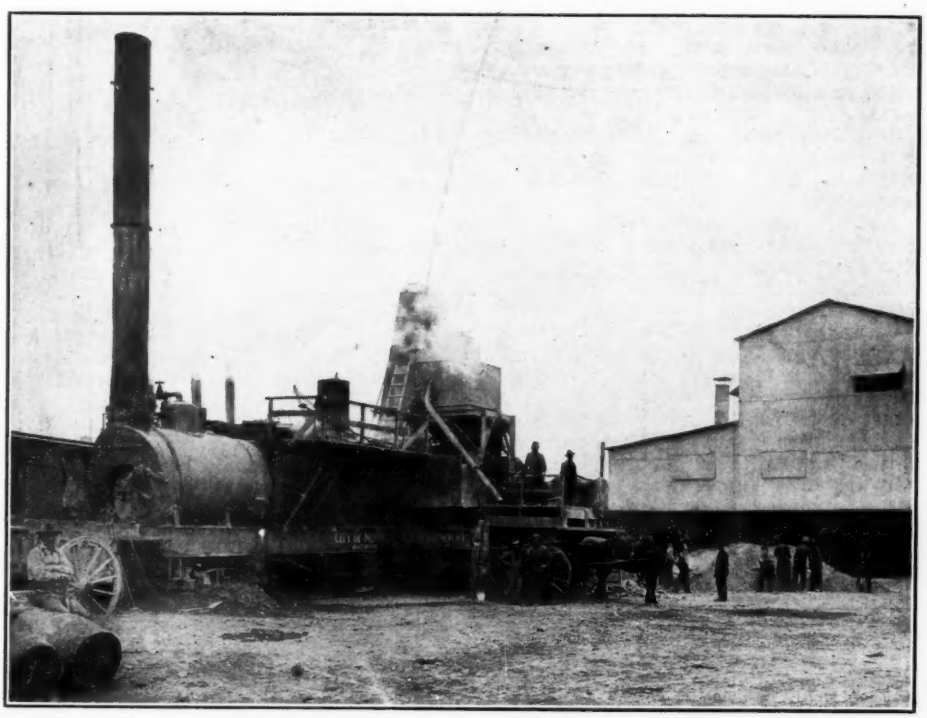
It did not require elaborate bookkeeping for the city of Marshalltown, Ia., to keep track of the operating expenses of a Kissel-Kar hose and chemical truck from April 1, 1912, to April 1, 1913. Here are the brief but eloquent figures:

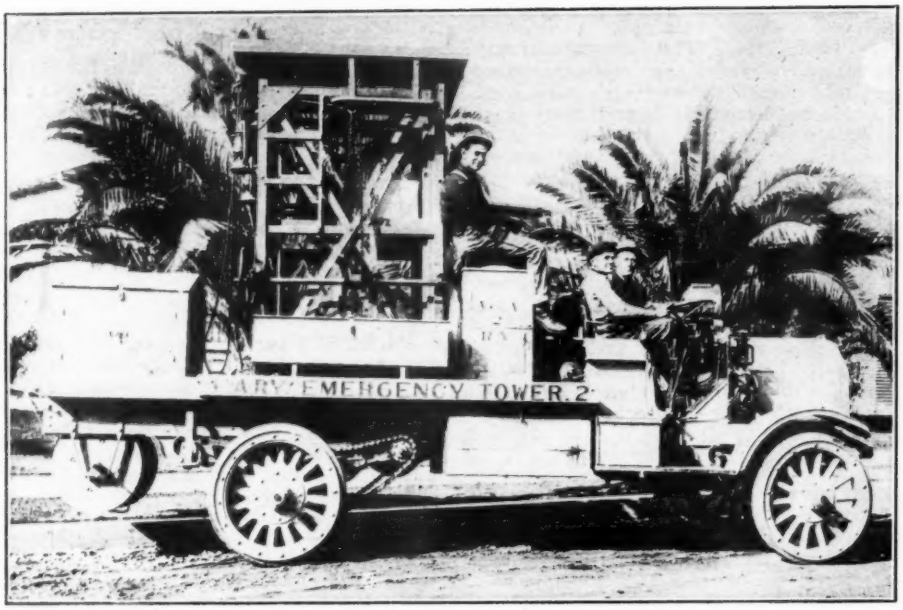
Tires	Nothing
Gasoline	$23.00
Repairs and replacements	.85
Lubricants	9.50
Total	$33.35

During the period covered, 107 alarms were answered, so that the cost of operation per fire was a little less than 32 cents. "In addition to the low cost of maintenance, the city has been able thru the adoption of the Kissel-Kar, to eliminate one man from the service," adds Chief I. T. Kirby.

On July 4th the city of Kankakee, Ill., made a very urgent run of six blocks with its Kissel-Kar hose and chemical truck and had water playing on the burning building in less than two minutes from the time it left the engine house. "The first essential in fighting a fire is to get there is the shortest possible time and the Kissel-Kar fulfills this aim in every respect," says Chief M. S. Baker.

From New Orleans, La., comes the story of a three-mile run with a Kissel-





KISSELKAR *used for emergency tower for street railway or electric light wire repair force.*

Kar hose truck, a large part of the distance being thru a congested part of the city. The truck had to halt three times and make four sharp and dangerous turns, yet had water playing inside of seven minutes from the receipt of the alarm.

"It is the truck that gets there and comes back," was the terse but adequate description given a Kissel-Kar hose and chemical by Chief Frank Brodbeck, of Salina, Kansas, a veteran fire fighter who recently died, and the sentiment is echoed by his successor. Regarding this truck, Chief Brodbeck further remarked: "When this car was tried out, it was put to every test. We made a run of 1.1 miles thru heavy gumbo in eight minutes. The best kind of a team could not have pulled thru at all."

For the initial tryout in Quincy, Mass., the department's hose and chemical Kissel-Kar was loaded with 21 men and sent over the hills known as the Wollaston section, comprising the hardest highways in the city. The test was entirely successful, and the truck in subsequent actual service, has lived up to its promise.

These are typical instances showing the maintenance economy and superior speed demonstrated in some of the cities where Kissel-Kar apparatus has been installed. Careful searching of the records fails to disclose a single complaint from any one of the thirty odd municipalities using Kissels in their fire departments. This is very remarkable when it is considered that there is no service to which a truck can be put where dependability and perfect performance are so essential as in fire fighting.

The South's Good Roads

That the South has not been getting due credit for its work in road improvement is indicated by a booklet just issued by the Barber Asphalt Paving Company, of Philadelphia. The first three or four pages contain 1914 photographs of Trinidad sheet asphalt pavements in Washington, D. C., Charleston, Louisville and New Orleans, that are from 20 to 30 years of age. These views are followed by a score of pictures of the types of roadway now being built in Southern states. Virginia, Maryland, North and South Carolina, Georgia, Tennessee, Alabama and Florida are among the states represented. Bermudez asphaltic concrete predominates, but there are many fine examples of asphaltic macadam or "penetration" roads and of highways resurfaced with liquid asphalt carpet coats. Instead of this advanced road construction being confined to big cities and their vicinity it is more or less of a surprise to find that small towns are laying the best types of asphaltic concrete roadways and not infrequently on a cement concrete base.

Hot Penetration Road Oiler

The motor truck has come into favorable use by the man who builds roads, having solved two of his greatest problems by giving him an efficient machine for construction work and a satisfactory medium for transporting his materials. The 5½-ton Hewitt "hot penetration" road oiler, which has just been built by the International Motor Company, New York, is such a machine.

This motor truck is equipped with road oiling apparatus, designed for applying binders to roads in course of construction. This machine should in no way be confused with a machine for laying dust. It is a purely constructive piece of machinery for building roads, conforming with the latest ideas employed in the construction of the new trunk highways.

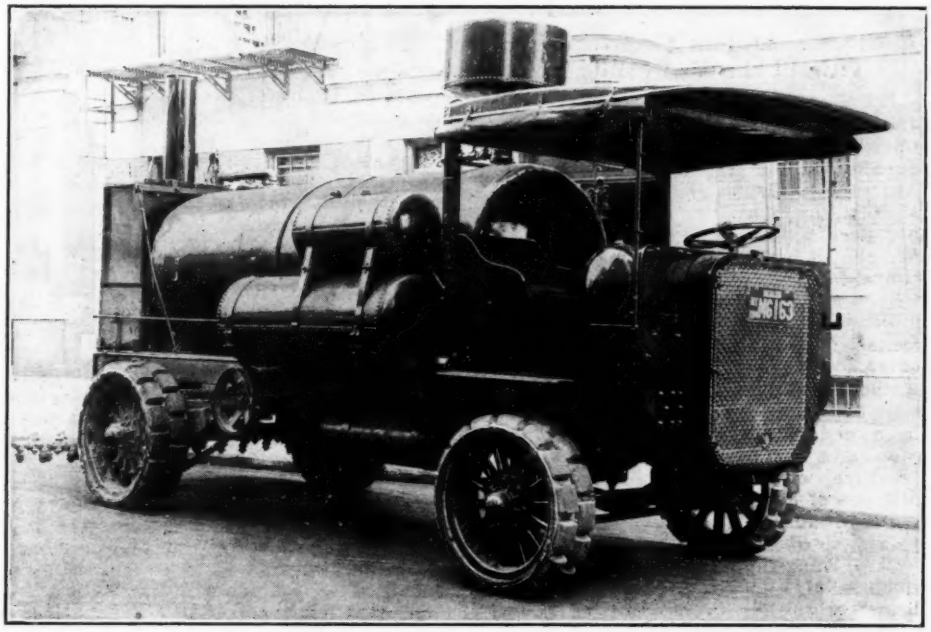
The rock construction of road built by this machine is very similar to the old-fashioned macadam. A permanent foundation is first laid, after which large crushed stone is applied according to the road specifications. The "hot road oiler" is then run over the road, applying a hot bituminous binder, which is forced onto the crushed stone under pressure. The hot oil fills up the interstices between the stones, holding them in place. As the binder hardens the stones are held more firmly in place, forming a solid mass of crushed stone and bituminous material. When the first course is finished, another layer of stone is rolled into place, the stones coming in contact with each other by the pressure of the steam roller; again a hot binder is applied by the "hot road oiler," filling up any crevices. In this way a solid road is obtained with no openings between the stones, and no moisture can get into the road and disturb its surface when it freezes, as is frequently the case in macadam roads. The stones are gripped in the bituminous binder and all spaces filled up, so that the stones cannot be picked out by automobile traffic. Of course, a road of this type has no dust.

This method of road construction is known as the "penetration method," and is one of the most economical ways of building a modern road.

The machine illustrated herewith is specially constructed for this class of work. It is a 5½-ton Hewitt truck, having sliding gear transmission with wide range of speed.

The large tank holds 750 gallons of binder. The binder in the tank is heated by coils of pipe in the tank, which coils are filled with steam. This steam is generated in the flash boiler at the rear of the truck. The boiler is fired by fuel oil which is carried in the upper cylindrical tank on the right-hand side of the truck. The steam from this boiler is also used to run a reciprocating "plunger type" air compressor, located on the left of the

HOT PENETRATION ROAD OILER, *with gasoline motor and pump.*



large tank near the front, just out of sight in the photograph. The air pressure forces the binder in the large tank onto the road. The lower cylindrical tank on the right-hand side of the truck carries the water for the boiler. The boiler is also provided with an air primer for starting the fire underneath the boiler.

Suitable arrangements have been provided for straining the binder when it is taken from the tank before reaching the distributing manifolds situated underneath the boiler at the end of the truck. They are seen in the photograph in part at the extreme left near the rear right wheel, and extend across the rear.

The operator is stationed at the rear of the truck, directly above the manifolds, so that he can control and regulate the application of the binder to the road. Provision is made for attaching a nozzle and hose to the distributing manifold and applying the oil locally by hand.

It can readily be seen that a full range is reached for the application of the binder, by varying the air pressure on the tank, by opening and closing the manifold nozzles, by varying the temperature at which the binder is applied, and by running the truck at different speeds.

Binder can be applied at the rate of from ¼ gallon per square yard to as much as 2 gallons per square yard.

This machine is one of the various types that the Standard Oil Company have in service in various parts of the country, and which they find of the utmost service in road work.

The Knox Motors Company is the Title of the Reorganization

By a decision just handed down by Judge Morton in the United States District Court of Massachusetts, the last question in the transfer of the old Knox Automobile Company to the new Knox Motors Company, of Springfield, Mass., has been settled. Judge Morton has confirmed the sale of the entire plant and property to E. O. Sutton, of Springfield, who is now treasurer of the new company.

Pending this confirmation of the sale, tentative plans for the conduct and wise extension of the Knox business had been formed and were partly under way, but with the receipt of news that the sale had been confirmed the execution of these plans was begun with a rush. H. G. Fisk, treasurer of the Fisk Rubber Company, and one of the best known men in the motor car industry, had already been elected president of the Knox Motors Company.

The Knox Company already had the nucleus of a dealers' organization thru branches in New York, Boston, Chicago and Kansas City, and these will be continued and their organization not only will be enlarged, but their scope increased widely.

The production department had already partially completed the thoro systematizing of the factory and the effect of Judge Morton's confirmation of the sale is to make possible the unification of the entire Knox organization, both producing and selling, in a way that has not been practicable heretofore.

Immediate results of the confirmation order were seen in the issuing of production orders for a number of Knox-Martin tractors and a quantity of fire apparatus of the latest design.

The latest Knox model touring cars were coming thru the factory at the time and an added impetus was given their production.

One of the first indications of the result of the formation of the Knox Motors Company has come in the applications of high grade dealers for allotments of territory and Knox products. The opportunity to handle Knox-Martin tractors, which have formed a large part of the production of the Knox Company, has proved a great incentive to dealers.

Semi-Portable Bituminous Mixing Plant

With the increasing use of bituminous macadam and the demand for closer economy and exact methods in asphalt road and street construction, the need has been emphasized for a relatively small, compact mixing plant of moderate first cost and minimum expense for maintenance. Such a plant must be suitable for various mixtures and sufficiently portable to overcome the loss entailed in excessively long hauls of the finished mixtures.

To meet these conditions the plant here described has been designed and built at the Iroquois works of the Barber Asphalt Paving Company.

The plant consists of four units—portable boiler and engine, portable single-drum drier, portable melting tank and mixing tower—which are so arranged that the plant in its entirety can readily be moved and reassembled.

The portable boiler and engine, selected for the particular duty to be performed, have power largely in excess of the actual requirements of the plant, thus insuring certainty of operation and permitting of flexibility in case it is found desirable to increase the normal capacity of the plant. The boiler is of 60-h.p. locomotive type with a 55-h.p. horizontal engine placed over the boiler shell. The entire unit is mounted on four substantial wheels.

The melting kettle has a capacity of 1,556 gallons and is a self-contained unit

with a refractory lined fire unit, fire and ashpit doors, and arranged for steam or air agitation, as the purchaser may prefer. This unit is mounted on three 6-in. heavy section I-beams for portability.

The single drum drier is of the "Iroquois" standard type, containing every refinement suggested by a quarter century's experience in the asphalt paving industry. The drum proper is 40 inches in diameter and 20 feet long, complete with fire brick and asbestos lined steel setting, firing chamber, double rain roof, elevators, etc. It is a complete self-contained unit mounted on substantial steel axles and wheels.

The mixing tower is constructed of four main columns, consisting of heavy section steel I-beams carrying the necessary platforms, all securely braced with tie rods and turnbuckles. To facilitate dismantling and re-erecting, the several members are bolted together. The mixing tower unit is fully equipped with a standard 9-cubic-foot "Iroquois" steam-jacketed mixer, with two sets of shafts and teeth, enabling the purchaser to produce any one of the several mixtures likely to be called for—binder, bituminous macadam, asphaltic concrete or standard sheet asphalt surface mixture. A two-compartment sand bin of total capacity of 218 cubic feet is supported between the upper legs of the tower. A rotary screen and cradle are mounted directly over the sand bin, and are equipped with jacket for the proper separation of the mineral aggregate; the screen can readily be jacketed to meet any modification in the mineral aggregate. The tower carries a dust collector of improved design and is so located that the dust collected is delivered above the line of the top of the mixer, making it available for use as "filler." The necessary accessories, such as weighing box and scale for mineral aggregate, traveler, bucket and scale for the bituminous material, power fan, link-belt elevators, etc., are parts of this unit.

Capacity. Those familiar with the production of bituminous surface mixture fully appreciate that the capacity of a mixing plant is limited by (a) the maximum capacity of the mixer employed and (b) the capacity of the dryer. In the plant here described the dryer has a capacity for handling a scientifically graded cold sand of the composition required for a standard sheet asphalt surface mixture, containing not more than five per cent of moisture, at air temperature 77° F., and delivering same to the conveyors at 350° F., at the rate of six tons (12,000 pounds) per hour of continuous operation. The mixer, however, has a capacity of more than double the capacity of the dryer, making it possible to double the capacity of the plant by installing an additional dryer unit and kettle unit. A superficial square yard of standard sheet asphalt surface mixture, 2 inches in thickness, may safely be assumed to weigh 200 pounds. The drum capacity is based on 160 pounds of sand (alone) included in a square yard of surface mixture consisting of sand, filler and asphalt cement. Six tons (12,000 pounds) of sand is the equivalent of 75 square yards per hour or 750 square yards of 2 inch thick surface per day of 10 hours. On coarser aggregates intended for bituminous macadam or asphalt concrete, the drum capacity will materially increase.

The plant as designed contemplates the use of steam for agitating the molten bituminous material. If desired, a complete air installation can be substitued. The first of these plants to be built has been purchased by the city of Springfield, Mass.

Hose That Will Not Crack

A constant source of injury to fire-hose is the compression of the rubber lining at the lines of the folds when the hose is rolled up or folded in place for storage.

HOSE *that will not crack. Note lining free from fabric on sides where fold comes and firmly attached where hose flattens in storage.*

The bi-lateral hose obviates this difficulty by leaving a band of the rubber lining about the area of the fold free from the fabric of the hose, cementing the lining to the fabric on the areas flattened in the folding. Humps at the ends of the flat sides relieve the pressure on the free end areas, thus preventing the flattening

down and creasing at the lines of folding. This results in making the life of the hose depend on the regular life of the lining and not on its ability to stand the misuse of the material in the folding, an obvious source of economy. The hose is put on the market by the Bi-Lateral Hose Co., 326 W. Madison St., Chicago, Ill., and is manufactured by the B. F. Goodrich Co.

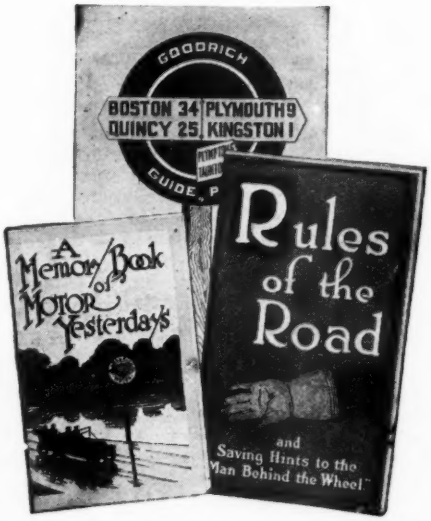
Goodrich Guides Motorists Over 300,000 Miles of Roads

From Cape Cod to the Golden Gate and from Michigan to Florida, the B. F. Goodrich Company's Touring Bureau has covered the country with sign-posts to guide the motorist on his way.

Not only that, but the Goodrich Touring Bureau has mapped almost every good road in the country and put its vast collection of data, relating to routes and touring information, in its famous Route Books, which we are now ready to distribute free.

Year by year this service, the only one of its kind in the world, has been extended till now, 1914, will see 300,000 miles of the best touring routes in this country, Canada and Europe, plotted so that motorists can go anywhere they want to and have a safe and sure guide all the way, either with a Route Book for the section or by the road markers, which have been set up to the number of 45,000 or more.

There are also 'road logs' of different tours and routes connecting the large centers of population throughout the United States and Canada; 'Rules of the Road,' crammed full of information about driving, care of car and tires, and other data; and the 'Memory Book of Motor Yesterdays,' in which the tourist can record his trip records, odometer readings, speedometer readings and character of hotels and garages found on the way.


GOODRICH
BOSTON 34 PLYMOUTH 9
QUINCY 25 KINGSTON 1
A Memory Book of Motor Yesterdays
Rules of the Road
and Saving Hints to the Man Behind the Wheel

All these books can be obtained by motorists at their nearest Goodrich branch, or by addressing The B. F. Goodrich Company, Akron, Ohio.

Weight of Jacksonville, Fla., Ladder Truck

In the advertisement of the Goodrich wireless truck tires on advertising page 11 of the May number of MUNICIPAL ENGINEERING, appeared a photograph of the motor ladder truck used by the fire department of the city of Jacksonville, Fla., with the statement that it weighed 18 tons. This is an obvious error and the weight is actually about 8 tons.

Steel Cells for Jails and Prisons

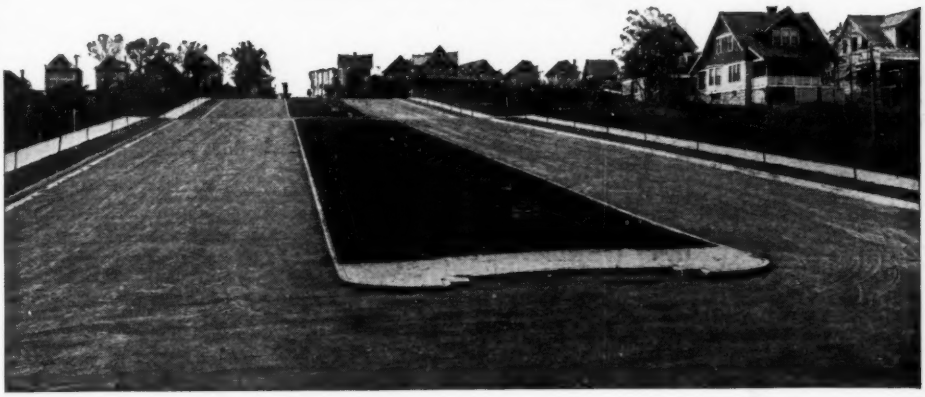
Two important steel jail cell contracts have been recently awarded to the Van Dorn Iron Works Co., of Cleveland, Ohio, who are specialists in steel prison cell constructions, one at Bakersfield, Cal., for the new Kern county jail and the other at Charlotte, N. C., for the new Mecklenburg county jail.

These contracts were placed with the Van Dorn Iron Works Co., thru the merits of its special tool-proof steel material, special sanitary interlocking grating construction and the special keyless locking device for sliding cell doors, which features are included in other jails of their production.

Another important jail recently completed by this company is the Clarke county jail at Athens, Ga.

Tarvia

Preserves Roads
Prevents Dust



Esplanade, Brighton Ave. to Abbington Blvd., Kansas City, Mo. Constructed with "Tarvia X", Spring 1912.

How tarviated roads reduce upkeep—

ORDINARY macadam is surfaced with fine screening, the durability of which is necessarily slight. These particles are readily dislodged by traffic and are constantly shifting and rubbing, forming dust which is washed or blown away.

After a little time this surface disappears, exposing the lower layers of coarser stone. The large stone of the lower courses, thus exposed, shifts under the weight of traffic and the road then begins to ravel hopelessly and requires an expensive renewal.

These larger stones, if they could be held in position, are capable of giving more wear than the fine stone of the surface.

One of the many economies of the Tarvia treatment is that it is so efficient a binder that it permits the use of large stone clear up to the wearing surface, screening being used merely to even up the surface for the sake of smoothness.

In this matrix of Tarvia, the larger stones take the direct wear of traffic. They cannot shift, and the road grows smoother with use and eventually becomes a mosaic of great durability. Very little care or renewal work is needed on such a road. It will stand heavy traffic without producing dust or mud. It is clean and attractive at all seasons.

If you are interested in the good roads proposition, write for the free booklet covering the Tarvia treatment.

BARRETT MANUFACTURING COMPANY

New York Chicago Philadelphia Boston St. Louis Kansas City Cleveland Cincinnati Minneapolis Pittsburgh Seattle Birmingham

THE PATERSON MFG. CO., Limited: Montreal, Toronto, Winnipeg, Vancouver, St. John, N. B., Halifax, N. S., Sydney, N. S.

TRADE B MARK

Architects, engineers and county, city and state officials contemplating work of this kind should have the catalog issued by this company, as it contains valuable information.

Condition of New Jersey Roads

A recent survey of the condition of roads in Essex, Union, Morris, Passaic and Hudson counties in the neighborhood of Newark, N. J., showed in general an excellent condition of the roads, but there were many places in which careful and intelligent repair is much needed. A long list of places needing repair is given, which shows that even in this district of good roads, some of them built twenty years ago or more, the methods of repair are not all that could be desired.

Most of the roads are of macadam, and much of this macadam is worn down to the broken stone of the foundation and will need repair at once or complete reconstruction after another season or two of neglect. Some of these areas are being repaired by the process of dumping broken stone and letting the traffic compact it, the road roller not being seen frequently. This process produces a poor road at a very high repair cost. In some places soil is mixed with the stone as a binder and the results will be better, tho still not good.

In the county of Essex, 15 of the 166 miles of county road require general overhauling and only a small portion of the remainder requires even minor repairs.

The shoulders along some of the bituminous roadways require filling with earth or cinders, the hard surface being too narrow for passage of vehicles by each other, except with great care, without running partly on the soft shoulder.

Most of the roads, particularly in Essex county, are reported to be in excellent condition.

Trade Notes

It doesn't require much imagination to see that the retail tire business is fast becoming the big end of the automobile business. Soon the profits from the sale of tires for old cars will exceed the profits from the sale of new cars. They do now in some places. That's why progressive dealers everywhere are taking up the sale of tires seriously, and the Goodyear Tire and Rubber Co., of Akron, O., are securing its share of the business by their modern methods of selling added to the high quality of their product.

The Peebles Paving Brick Company, which has two plants at Portsmouth, O., has purchased a plant at Firebrick, Ky., and will manufacture the Dixie brand of Dunn wire-cut-lug brick.

The Duluth office of the H. W. Johns-Manville Co. has moved to larger quarters at No. 327 W. First street, in order to take care of its increased business. The new office is on the ground floor, with windows for the display of J-M asbestos roofing, pipe coverings, packings, sanitary specialties, auto accessories and other products of this company's well known and varied lines.

George Griffiths, 418 Odd Fellows Bldg., St. Louis, Mo., and C. A. Cleaver, 122½ Main street, Houston, Texas, have recently taken the agencies in their respective territories for the chain belt concrete mixer, chain belt paver, the chain belt line of distributing spouts and towers and other concrete machinery manufactured by the Chain Belt Company, Milwaukee, Wis.

"The Buffalo Foundry & Machine Co., of Buffalo, N. Y., announce that they have terminated the arrangement whereby H. E. Jacoby has been representing them in New York City and vicinity. They are now handling direct all inquiries covering vacuum apparatus, castings, patterns, and machine work."

Trade Publications

Section A of Catalog 110 of the Link-Belt Co., Chicago, Ill., is devoted to the original Ewart detachable link-belt and sprocket wheels, invented in 1873 and the first presented to the public. The Link-Belt Co. are still the largest manufacturers of this type of belt. All the illustrations in the catalog are from photographs and show the belt and attachments as they are actually made and used.

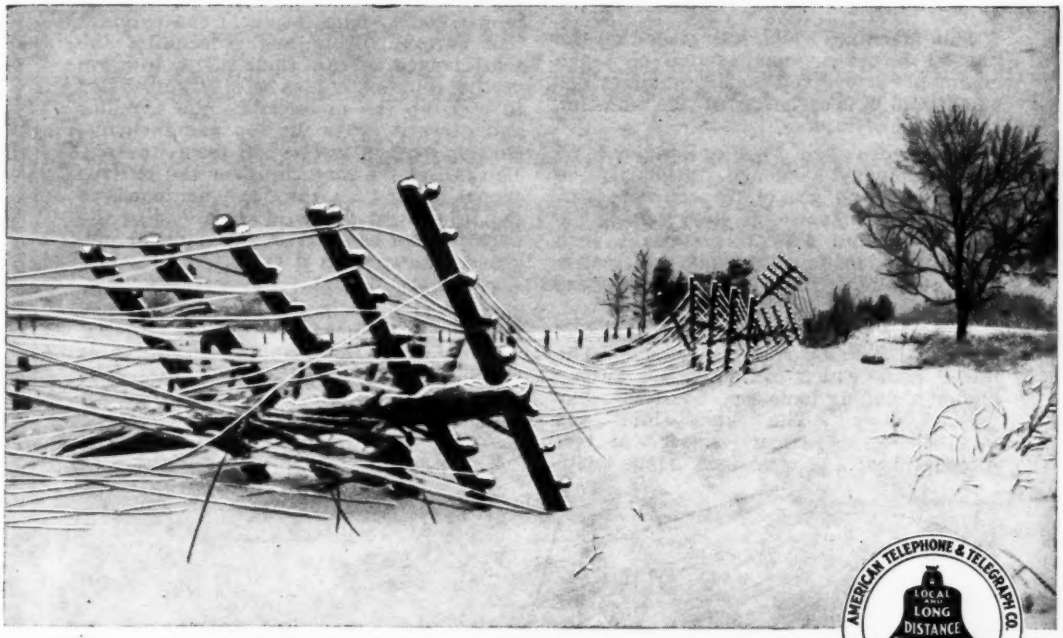
The Kindling squeegee and the Kindling sand spreader are lfuly described in a new catalog issued by The Kindling Machinery Co., Milwaukee, Wis., which gives the results of tests and of regular operation of the machines in New York and Washington.

The latest applications of metal lath to building construction and the results of using less fireproof methods of construction are shown in the June monthly bulletin of the Northwestern Expanded Metal Co., 37 W. Van Buren St., Chicago, Ill.

Concrete Roads is the title of a new series of bulletins issued by the Universal Portland Cement Co.

Artistic design in reinforced concrete bridges is illustrated by contrasting views in a circular issued by D. B. Luten, of Indianapolis, Ind.

Wagon and truck loaders for handling coal, coke, stone, sand and similar loose materials from storage are fully described in Book No. 190 of the Link Belt Company, of Philadelphia, Chicago and Indianapolis.



The Telephone Emergency

THE stoutest telephone line cannot stand against such a storm as that which swept the Middle Atlantic coast early in the year. Poles were broken off like wooden toothpicks, and wires were left useless in a tangled skein.

It cost the telephone company over a million dollars to repair that damage, an item to be remembered when we talk about how cheaply telephone service may be given.

More than half of the wire mileage of the Bell System is underground out of the way of storms. The expense of underground conduits and cables is warranted for the important trunk lines with numerous wires and for the lines in the congested districts which serve a large number of people.

But for the suburban and rural lines reaching a scattered population and doing a small business in a large area, it is impracticable to dig trenches, build conduits and lay cables in order that each individual wire may be underground.

More important is the problem of service. Overhead wires are necessary for talking a very long distance. It is impossible to talk more than a limited distance underground, although Bell engineers are making a world's record for underground communication.

Parallel to the underground there must also be overhead wires for the long haul, in order that the Bell System may give service universally between distant parts of the country.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*

Dull's Tubular Washer

This machine, which was placed on the market last year, has excited so much comment and given such excellent results that a description of the machine should be of interest.

It was designed by the Raymond W. Dull Company, Chicago, primarily to wash sand and gravel for concrete purposes and it answered this purpose so well that more difficult materials, such as filter sands, foundry sand and materials containing coal dust have been washed.

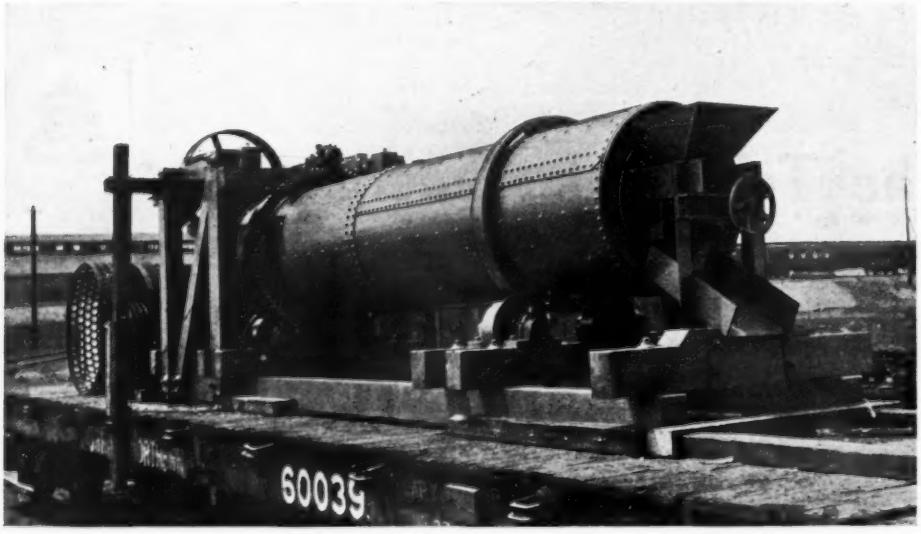
A recent experiment for a large steel foundry showed surprising results. The waste sand, which contained a fire clay binder including molasses, flour, etc., was washed clean. The sand which was washed was put thru a series of test screens and a comparison made with fresh foundry sand showed that the percentages were almost identical with the grading of the fresh sand. The refuse also was very critically examined by experts, who pronounced that it contained practically no good material.

The operation of the washer is very simple. The machine consists of a cylinder which revolves on chilled trunnion wheels. The inside of the cylinder has several lifting angles running the total length of the shell. The rotation of the cylinder causes the lifting angles to pick up the material in the cylinder and carry it up to the top and then discharge over a series of fixed shelves. The fall of the material over the shelves scours it and as they are arranged so that the lower series is set ahead of the upper series of shelves the material progresses forward as it falls.

The washing water flows in the opposite direction from the travel of the material, which insures that the material will be discharged where the water is cleanest. The cylinder has closed ends with center openings and this retains considerable water in the machine to do the washing.

The progress of the material thru the machine is governed by moving the lower series of steps. By increasing the number of falls of the material the most difficult materials can be washed. The machines are made in four different sizes, ranging from 30 inches in diameter and 8 feet long, to 60 inches diameter and 20 feet long. They are constructed of heavy boiler plate and have steel tires and trunnion wheels with chilled tread.

The machines are manufactured and sold by the Raymond W. Dull Company, 1910-1912 Conway Building, Chicago, Ill., who are specialists in sand and gravel handling machinery.



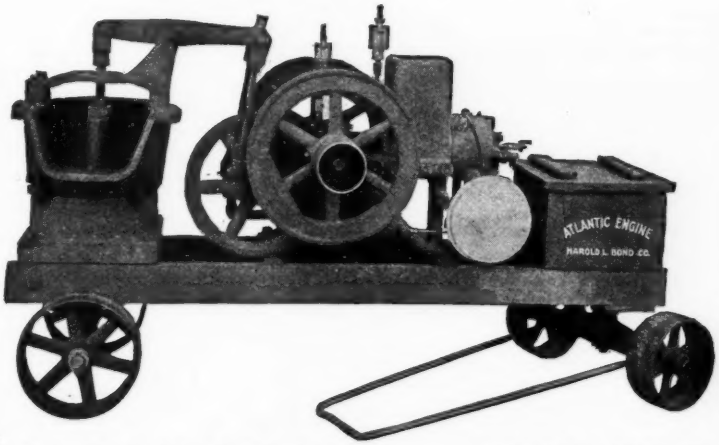
DULL'S *tubular washer for washing sand and gravel. Note that water enters and the washed material leaves the washer at the upper end.*

Study these Improvements

They increase the Efficiency, Durability and Capacity of the

ATLANTIC DIAPHRAGM PUMP

and they are *exclusive features.*



New 4-inch Atlantic Diaphragm Trench Pump.

List Price, $165.00.

OBSERVE THE

Special Top Head
Rigid Fulcrum
Positive Piston Stroke
Improved Waterway

Lost Motion Eliminated

Valve seat is machined, making a much more dependable closing of valve. Water inlet is changed in direction to decrease friction.

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CONTRACTING NEWS

AUTOMOBILES.

FIRE APPARATUS.

Benton, Ill.—Bond issue of $15,000 voted for creating city fire department. S. B. Espy, mayor.

Cleveland, O.—Ordinance authorizing special election for issuance of $300,000 bonds for addition of ten more companies to fire department, proposed by Geo. Lomitz, chairman of fire department advisory board. A. A. Benesch, public safety director.

Duluth, Minn.—Entire fire department will be motorized; police department will also be equipped with small automobile. Jos. Randall, fire chief.

Galveston, Tex.—Purchase of an automobile ambulance for city is recommended by Mayor Lewis Fisher.

Girard, Ohio—Installation of an electrically operated fire alarm system and purchase of auto truck and other equipment is being considered by city council. Thos. G. Blackstone, mayor.

Lorain, Ohio—Ordinance for purchase of a second auto aerial ladder truck is being considered. J. J. Pollock, mayor.

Marion, Ohio—Bond issue of $10,000 voted by council for purchase of automobile engine pump; ordinance adopted for issuing $5,000 bonds to pay difference in changing auto chemical wagon for an auto fire engine pump. Don E. J. Brockett, mayor.

San Antonio, Texas—City purchasing agent instructed by council to advertise for one motor-driven police patrol wagon, cost $3,500, and two automobiles for police and detective departments at $1,500. Phil Wright, fire chief.

BRIDGES.

BIDS REQUESTED.

Cleveland, Ohio—July 22, until 10 a. m., for reinforced concrete arch bridge on Pearl road across Big Creek Valley. Certified check, $10,000. E. G. Krause, clerk, board of Cuyahoga county comrs.

Phoenix, Ariz.—July 13, until noon, for 22-foot reinforced concrete bridge over Salt River Valley Canal on Phoenix-Temple highway; also 25-foot reinforced concrete bridge over Maricopa canal on same road. Jas. Miller, Jr., clerk, Maricopa county supervisors.

Toledo, Ohio—July 17, until 10 a. m., for bridge and abutments on Wood street over Miami and Erie canal in Waterville Village, and bridge and abutments on Canal street in Maumee. Certified check, $500.00. Chas. J. Sanzenbacher, auditor Lucas county.

CONTRACTS AWARDED.

Chillicothe, Ohio—To Oather M. Junk, Chillicothe, substructure of Main street bridge over Scioto river at $24,505; to Capital Construction Co., Columbus, O., superstructure of same at $44,625; to Wylie & Renick, Circleville, O., substructure of Higby bridge, Jefferson and Franklin townships, and superstructure of same to E. M. Scully, Columbus, O.

Freehold, N. J.—To Owen J. Melee, Long Branch, N. J., reconstruction of bridge over Parker's creek at $17,900.

Indianapolis, Ind.—To Central States Bridge Co., 601 Beecher street, city, superstructure of Minnesota street bridge over Pleasant Run, at $7,385.

Los Angeles, Cal.—To Mersereau Bridge & Construction Co., 471 Pacific Electric Bldg., city, steel bridge over Calf Canyon at $13,146, and steel bridge over Old Creek crossing at $12,960.

Paso Robles, Cal.—To Gottleiben Bros., San Francisco, steel bridge at $44,328.

BUILDINGS.

BIDS REQUESTED.

Ben Davis, Ind.—July 10, until 2:30 p. m., for two-room addition to school house in Wayne township, Marion county. G. D. Harding, trustee.

Cincinnati, Ohio—Until September 1, for construction of Hamilton county's courthouse building. Estimated cost $2,500,000. Specifications may be obtained by depositing check for $250.00 with Architects Rankin, Kellog & Crane. For further information address New Courthouse Building Commission.

Macedonia, Ohio—July 17, until noon, for brick school building. David Grimm, clerk, board of education.

Medora, Ind.—July 18, until 9 a. m., for remodeling school building in Carr township, Jackson county. Joel B. Henderson, trustee.

Springfield, Ill.—July 20, until 3 p. m., for erection of following buildings: One Morgue and Laboratory; one Receiving Cottage for Men; one Amusement Hall, Peoria State Hospital, South Bartonville, Ill., and one Horse Barn at Soldiers Home at Normal, Ill. Frank Dibelka, state architect, 29 S. LaSalle street, Chicago.

Wheatfield, Ind.—July 18, until 2 p. m., for an addition and alterations to high school building, Wheatfield township, Jasper county. A. S. Keene, township trustee.

CONTRACTS AWARDED.

Belton, Texas—To Hart & Gaught, Ft. Worth, brick high school building, at $39,545.

Breckville, Ohio—To Rowe & Giles, Chagrin Falls, school building, at $23,523.

Chattanooga, Tenn.—To D. F. Brandon, city, remodeling police headquarters for marketing place, at $13,050.

East Orange, N. J.—To Tobin Mason & Building Co., city, six-room addition to Franklin school building, at $32,945.

Ely, Minn.—To Boyd Construction Co., Germania Life Bldg., St. Paul, 2-story and basement school building, at $125,000.

Knox, Ind.—To Peter Holen & Son, Grovertown, Ind., 2-story brick addition to high school building, at $4,185.

Lestershire, N. Y.—To John Schultie, city, school building, at $71,000.

Peru, Ind.—To Chas. Clifton, city, school building, at $17,661.65.

Rushville, Ind.—To Steven Purcell, Rochester, Ind., school building, at $41,990.

Topeka, Kans.—To Lundgren & Carlson, Topeka, addition to high school building, at $45,369.

Waterford, Ind.—To L. A. Kunkel, Michigan City, Coolspring township school building, at $5,500.

Wilmington, N. C.—To W. P. Rose, Goldsboro, Hemenway school building, at $33,550.

CONTEMPLATED WORK.

Bentonville, Ark.—Plans being prepared by Stevens & Nelson, architects, New Orleans, La., for Benton county courthouse. Esti-

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mated cost, $175,000. H. C. Smith, county judge.

Butte, Mont.—Issuance of $150,000 bonds for school buildings will be voted August 5. W. I. Willis, city clerk.

Canton, Ga.—Bond issues of $25,000 and $5,000 voted for erection of school building and city hall.

Greenville, S. C.—Erection of Municipal Hospital being planned. Bond issue, $40,000.

Hamtramck, Mich.—Plans being prepared for 2-story and basement school building for School District No. 8, by Geo. A. Hass, architect, 307 Moffat Bldg., Detroit, Mich. Estimated cost, $7,000.

Joplin, Mo.—Construction of an annex at Municipal Orphanage proposed. Estimated cost, $5,000. Hugh McIndoe, mayor.

Myerstown, Pa.—Plans for 2-story stone high school to cost $50,000 being prepared by Edward Z. Scholl, 31 North 6th street.

Poland, Ind.—Construction of grade school building to be considered at mass meeting held July 11.

Salt Lake City, Utah—$70,000 appropriated for erection of 6-room addition to summer school and for completing first unit of Ensign school. Address board of education.

Union Grove, Wis.—Construction of Union high school for Racine and Kenosha counties in this village at cost of $13,000 is being considered. G. J. Zimmerman, Jr., county superintendent of schools.

LIGHTING.

CONTRACTS AWARDED.

Livingston, Mont.—To Beley Construction Co., Livingston, installation of lighting system, at $14,944.

Mangum, Okla.—Resolution adopted cancelling a 25-year contract with Mangum Electric Co. for street lighting. Installation of Municipal Light and Ice plant is being considered. Mr. Border, mayor.

Melvin, Ill.—To Central Illinois Utilities Co., 22 street lamps of 60. c. p., at $30.00 per year; contract is for 10 years.

Monticello, Ind.—To M. J. Hoffman, city, system of boulevard ornamental lights, at $2,356.92.

Newport Beach, Cal.—To F. O. Engstrum Co., 5th and Seaton streets, Los Angeles, installation of ornamental lighting system, at $14,000.

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Bowling Green, Ohio—July 14, until 1 p. m., for grading, draining and macadamizing and applying tar and bituminous binders and constructing earth road on various roads in Wood county. Certified check, $500.00. C. E. Stinebaugh, auditor.

Cameron, Texas—Until July 15, for constructing macadam, gravel and concrete highways in Road District No. 2, Milam county; $150,000 available for work. J. C. Field Engineering Co., engineers, Field Bldg., Dennison, Texas.

Edon, Ohio—July 24, until noon, for paving Michigan street and Indiana streett. Certified check, $4,000, made payable to H. L. Eyster, village clerk. Geo. Champe, civil engineer, 610 Nasby Bldg., Toledo, O.

Wapello, Iowa—July 15, until 11 a. m., for 8,003 cubic yards road grading on Wapello-Newport county road; 8,424 cubic yards on Wapello-Columbus city road, and 19,300 cubic yards on Newport-Morning Sun road. Certified check, 5 per cent. of bid, made payable to H. W. Baker, county auditor.

Wauseon, Ohio—July 14, until 1 p. m., for joint county road improvements Nos. 17 and 11; lengths, 6 miles and 2 miles respectively. Certified check, $500.00, made payable to W. W. Ackerman, auditor, Fulton county.

CONTRACTS AWARDED.

Angola, Ind.—To H. L. Janney Co., Muncie, Ind., paving of West Maumee street, with brick, at $28,698.

Baltimore, Md.—To Baltimore Asphalt Block & Tile Co., city, resurfacing Riverside avenue with sheet asphalt, at $7,635, and paving of Eighth street with sheet asphalt, at $37,507.52; to American Paving Co., city, paving 14 streets with sheet asphalt, at $64,535.

Chattanooga, Tenn.—To West Construction Co., city, vitrified brick paving on Chestnut street, at $15,444.10, and on 26th street, at $6,633.90; to Key-Arnold Co., city, vitrified brick paving on Main street, at $14,181.95.

Dixon, Ill.—To Rink & Schnell, brick pavement on Central avenue, at $20,381.43; to J. W. Kelly, city, concrete pavement on Seventh street and Chicago road, at $9,751.01; to Gund & Graham, Freeport, brick paving on East Second street and Crawford avenue, at $18,536.27; to Chas. E. Hughes, Rockford, brick paving on East Fellows street, at $12,167.79; to Duffey & Hubbard, city, macadam on East Everettt street, East Boyd street, and North Jefferson avenue, at $13,023.01; to Duffey & Hubbard, macadam, on East Chamberlain street, at $11,739.40; to Charles E. Hughes, planking between rails on River street, at $5,141; to Gund & Graham, brick paving on East River street, at $16,747.05.

DuBois, Pa.—About $9,000 will be expended on street improvements this summer. Material, brick. A. L. Bouton, city engineer.

Evansville, Ind.—To Western Construction Co., Trinidad Lake asphalt paving on eight streets, at $1.90 per square yard; to Pritchard Bros. Co., reinforced concrete pavement on Morris avenue and Jackson avenue, at $1.50 per square yard; to Bedford Nugent Co., Albion shale brick pavement on Water street, at $1.54 per square yard.

Franklin, Pa.—To Northwestern Construction Co., 13,000 square yards brick pavement on Grant and Atlantic streets, at $27,790.

Marietta, Ohio—To McGarey & Stowe, Akron, Ohio, 4.27 miles Washington county concrete road, at $55,580.

Newcomerstown, Ohio—To Wm. Brode & Co., city, two stretches of road paving in Tuscarawas county, at $54,784.

Norway, Mich.—To B. W. Hicks, Vulcan, Mich., bituminous macadam paving on Nelson street, at $7,300.

Orlando, Fla.—To Alabama Paving Co., Birmingham, street paving construction amounting to $200,000; to Hamilton Johnson, Orlando, curbing construction, at 30 cents per square yard.

Petersburg, Ohio—To Kennedy Bros., Youngstown, macadamizing Springfield-Poland roads, at $30,406.

Redmond, Wash.—To L. R. Ellis, Seattle, two miles brick paving on Redmond-Snoqualmie road, at $41,435.

Rockford, Ill.—To A. E. Rutledge, city, macadam'zing of North Second street, at $12,221.55.

Salem, Ind.—To The Milroy Construction Co., Salem, paving of East Market street, at $11,000.

Sandwich, Ont., Can.—To Lennane Bros., Detroit, Mich., paving of Bedford street; contract price about $40,000.

Upper Sandusky, Ohio—To National Lime & Stone Co., Carey, Ohio, about 2 miles of pavement on Upper Sandusky-Findlay road, at $20,625; to Barnes and Almendinger, Rocky Ridge, about one mile of paving on Uncapher road, at $10,799.

V=A=N=D=O=R=N

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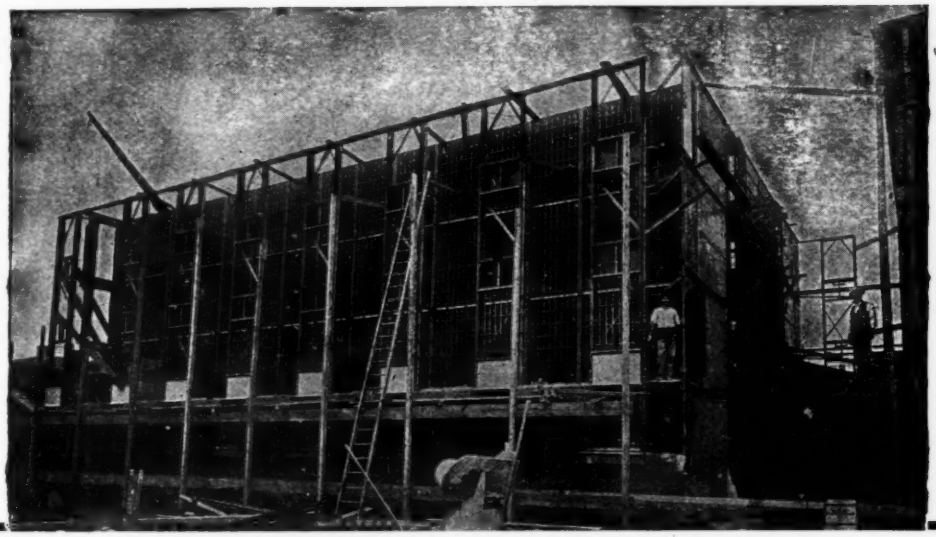

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CLEVELAND, OHIO.

CONTEMPLATED WORK.

Canton, Ohio—Contemplated improvement of Tuscarawas street, Market avenue, to Harrison avenue, by widening and repaving, estimated to cost as follows: Brick paving, $113,256, asphalt paving, $145,258, and wood block paving, $187,291. W. E. Sarver, city engineer.

Indianapolis, Ind.—Specifications adopted for paving East New York street, Arsenal avenue to Belt R. R. Estimated cost, $75,000. B. J. T. Jeup, city engineer.

Manatee, Fla.—$120,000 available for asphalt and brick paving. John Lloyd Minnis, engineer, Tarpon Springs, Fla.

Miami, Fla.—Contract will be awarded in August or September for 200,000 square yards of paving. Material not chosen. B. H. Clyce, city engineer.

SEWERS.

CONTRACTS AWARDED.

Aledo, Illinois—To Dalton Bros., Wilmette, Ill., sewage system, at $5,316.40.

Holley, N. Y.—To Frank S. Sposaeto, Syracuse, sewer system, at $39,074; to Foote & Graid, Rochester, sewage disposal works, at $9,700.

Indianapolis, Ind.—To Dunn-McCarthy Co., of Chicago, for Pogues Run sewer construction. Contract price, $907,061.31.

Perry, Iowa—To the Katz Construction Co., Omaha, Neb., west side sewer system, at $10,533.

Virginia, Minn.—To Lawrence McCann Construction Co., city, sewer system, at $66,072.56.

White Sulphur Springs, Mont.—To C. H. Kelly, Kalispell, Mont., sanitary sewer system and sewage disposal plant, at $10,524.

CONTEMPLATED WORK.

Fredonia, Kans.—Construction of sewer below dam in Fall river, at cost of $25,000 proposed. Hal McFadden, city engineer.

Indianapolis, Ind.—Plans adopted by board of public works for construction of sewer in College avenue from 38th to 50th street. Estimated cost, $218,000. B. J. T. Jeup, city engineer.

Lyons, N. Y.—At special election held recently expenditure of $135,000 voted for installation of sewer system and sewage disposal plant.

Olathe, Kans.—Contract will be awarded in August or September for about 2,300 lineal feet vitrified pipe sewers of 8-inch; 2,400 lineal feet vitrified pipe of 10-inch; 4,700 lineal feet of trenching 6 to 14 feet deep. Estimated cost, $5,500. Roy Murry, city engineer.

Warroad, Minn.—Plans being prepared for proposed sewer system by Geo. W. Walker, engineer, Thief River Falls, Minn.

WATER WORKS.

BIDS REQUESTED.

Casper, Wyo.—Until about July 15, for water system costing $75,000. L. S. Worthington, city engineer.

Orillia, Ont., Can.—July 13, until 9 a. m., for water works extension. E. Long, chairman Orillia Light & Power Commission.

CONTRACTS AWARDED.

Cut Bank, Mont.—To C. H. Coffin, Chicago, Ill., water works system, at $29,000.

Hibbing, Minn.—Offer of Layne & Bowler Co., Texas, accepted by village council for furnishing water supply for village, at $398,855.

Umatilla, Ore.—To W. G. Mulligan, Spokane, Wash., installation of water system, at $20,044.

CONTEMPLATED WORK.

Antigo, Wis.—Bond issue of $100,000 voted for purchase of city water works. Alex. Deleglise, city engineer.

Bay Minette, Ala.—Plans being prepared for proposed water works system at cost of $25,000 by Edgar B. Kay, consulting engineer, Montgomery, Ala.

Chinook, Mont.—The Jaqueth Co., Kalispell is preparing plans and estimates for filtration plant.

Milford, Ellis County, Texas—Bond issue of $14,000 carried for installation of water works system.

Milwaukee, Wis.—Improvements to water system consisting of short tunnel costing $275,000, a tunnel from intake tunnel to new station, at $350,000; pumping station with equipment, at $220,000, and several minor improvements are contemplated. H. P. Bohmann, water works superintendent.

Woodruff, S. C.—Bond issue of $60,000 for installation of water system will be voted on July 7.